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THE FRONTIERS OF PSYCHOLOGY

by

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GENERAL INTRODUCTION

The Contemporary Library of Psychology has been planned to meet what is felt to be a need alike of the student and of the large and growing public who take a keen and intelligent interest in the subject. In common with all other sciences, Psychology is continually enlarging its boundaries by the discovery of fresh facts, the construction of hypotheses to explain them, and the verification of the hypotheses in experimental conditions. Unlike those of the other sciences, however, the claim of which to acceptance has long been established, its principal achievements are of comparatively recent origin. No doubt many of its problems are as old as philosophy itself; but their ancient solutions were of a highly speculative character, and it is only since the application of scientific method to the data of mental life that it has been possible for Psychology to take its place within the ranks of the empirical and experimental sciences.

Its scientific progress, however, has since then been astonishingly rapid; so rapid, indeed, that it has not failed to be accompanied by certain dangers incidental to speedy growth from infancy to adolescence. There have been the dangers, not always successfully avoided, of non-observation and of mal-observation, of hasty generalisation from

insufficient data, of immature and faulty method, of imperfect experimental technique, and the like.

Even now, when all these have in large measure been overcome, and an incomparable method devised by which psychological data may be treated mathematically, there are still numbers of divergent schools each claiming to be the sole genuine representative of the science. This is in the main, if not entirely, due to the fact that workers have laboured more or less independently in separate and even isolated areas within the psychological domain. Some have specialised in the abnormalities of mind, and from their clinical observations have derived a general theory which they then extended to cover mentality as a whole. In this general theory the emphasis is upon the emotional character of mental life, and especially upon the dynamic nature of the Unconscious. Others, interested in animal and human behaviour rather than in the mental processes themselves, have found consciousness a superfluity for purposes of explanation, and have stressed a few native reaction-patterns as the basis upon which all behaviour is built up. Others, again, have occupied themselves with mental processes as these are actually observed to occur, and have devised experimental means for their investigation. And so on.

A consequence of this divergence of interest, especially when the several views to which it leads are expounded in

text-books and manuals, and above all in summary expositions intended for more popular consumption, is that the reader is apt to form a one-sided and entirely misleading conception of Psychology. He may become an ardent psycho-analyst, a keen behaviourist, a formalist, a purist, or what not, as the case may be. But, while there is no doubt much truth in all these systems, which in point of fact considerably supplement one another, there is still in most of them a great deal that is of the nature of assumption and over-generalisation. The literature, moreover, of late years has grown to such an enormous extent that it is almost impossible for any one person to master it, and so to gain for himself a comprehensive and accurate perspective of contemporary Psychology in so far as this science is definitely and systematically established.

The plan of The Contemporary Library of Psychology has been drawn up with a view to presenting such a perspective in a popular way, but at the same time without any loss of scientific accuracy. Each volume to be included in it will deal with a special and definite topic which is capable of independent treatment as a single chapter of Psychology. Though this plan inevitably entails a certain amount of overlapping, since no one volume will take for granted what has been set forth in another, and certain principles are of necessity common to all, overlapping will be restricted to a

minimum. The Series will, it is hoped, embrace all the major topics of the science, including those of Comparative, Abnormal and Applied Psychology. In this way each volume will be complete in itself; while the Library as a whole will cover the entire field of Psychology.

With this aim in view, it is confidently hoped that it will prove to be of real service both to the student and to the general reader.

F. A

PREFACE

The title of this volume might be understood in either or both of two senses. It might be taken to point to that mass of disputable and much disputed phenomena which are commonly ignored by the academic psychologist or, at the best, relegated by him to a special field of 'psychical research'. But most of the problems roughly indicated by that term seem to me to fall within the province of psychology proper. I use the word 'frontier' more literally, namely, to point to the relatively unexplored regions that lie between the recognised provinces of the established sciences. For in those regions (always the most fascinating to the curious mind) lie many problems which may be solved only by co-operation of two or more sciences.

More than any other science, psychology is, or must inevitably become, involved in such co-operative efforts. For every science is the product of mental activity; and, sooner or later, the workers in each science come up against psychological problems, questions as to the ways of working of the human mind, as to its liabilities to error, to bias and consequent distortion, to selection, emphasis and prejudice, as to the influence of all such peculiarities (whether universal or idiosyncratic) in shaping the conceptions and theories of each science.

It is characteristic of the present time that men of science

are ceasing to be as naïve as was the rule in the foregoing century, are beginning to become aware, however dimly, of their need for some psychological understanding. Perhaps we are within sight of the time when every scientific congress shall have its psychological section.

It is something of a paradox that while the sciences whose objects are most remote from man readily recognise their need for the co-operation of psychology, the human sciences are less disposed to seek such co-operation, and even may seem to resent the suggestion that they might profit from it. Here is one of the many frontier problems. To discuss it would be an invidious task; one for which I have no appetite. The task I have undertaken is inevitably a delicate one; and I prefer a policy of ingratiation and olive branches to one of rude outspeaking. If I seem to lack deference before names of such distinction as Sir James Jeans, Sir Arthur Eddington and Prof. Albert Einstein, that is an illusion arising out of the necessities of the situation.

Science suffers from the public's excess of suggestibility towards such master performers. The first condition of success in my undertaking is to steel myself against their prestige and their persuasiveness and to refuse to be carried away in the strong current of popular adulation. Fortunately, the study of psychology fortifies against suggestion; for it points to the limitations and the liabilities to error of even the greatest intellects. If the more intelligible utterances of these and other leaders of the new

physics seem to me 'a sort of mystic chant over an unintelligible universe', I console myself with the reflection that in this I am not quite alone, but am at one with Prof. A. N. Whitehead, whose genial characterisation I cite; even though I have not the courage to follow him in likening the 'chant' to an ancient magic ceremony.

In this little book it has been possible to treat only a small part of the vast regions indicated by its title. I have selected for discussion a few leading examples of typical frontier problems. It seemed necessary to preface these discussions with some remarks on the relations of the sciences to one another and to philosophy, and with some reflections on scientific method, truth, causation and the pragmatic principle. These are difficult topics to handle in a few pages. My hope of having made myself intelligible to the lay reader lies in the fact that my views on all these much-debated matters are simple, clear-cut, consistent, mature and emphatic.

WM. McD.

DUKE UNIVERSITY, N.C.
October, 1934.

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THE FRONTIERS OF PSYCHOLOGY

CHAPTER I

INTRODUCTION: THE RELATIONS BETWEEN THE SCIENCES

¶ 1. FRONTIERS OF STATES AND SCIENCES. The title of this little book makes use of an analogy on which we may with advantage reflect before plunging into our subject. The analogy likens all science or systematically organised knowledge of Nature to a great geographical area, such as a continent, partially explored and settled. Man has begun his explorations and settlements at various points of time and space more or less widely separated; and from each such point has gradually conquered from the wilderness and reduced to order of some kind and degree an expanding area. Each such area, country, or State, is the analogue of what we call a science. The inception of the exploration and settlement of the various areas was haphazard, that is to say was largely determined by historical accidents and urgent practical needs.

Our analogy may be made more concrete by keeping in mind the continent of North America. Looking back upon the history of the European settlement, we can see how advantageous it would have been if the whole process could have been planned and organised from the first; we can see how much conflict and disorder might have

been spared; how mutual assistance and cooperation might have greatly lightened the labour of all concerned; how the forces of barbarian violence and superstition might have been peacefully subdued, transformed and assimilated.

Such an ideal process of planned development was, of course, impossible; each small expanding area of order was for long independent of and, in many cases, in conflict with other areas. As, in the course of generations, the various settlements became increasingly aware of one another, there was jealous controversy as to rights and boundaries; some areas soon coming into contact, or even overlapping with one another; others remaining separated by tracts of untrodden wilderness. Thus the frontiers are of two kinds; on the one hand, those frontiers which are merely lines separating well defined and well settled areas; on the other hand, extensive tracts of still unsettled wilderness adjoining some settled areas and completely surrounding others. Progress towards the complete ordering of the whole continent requires not merely the work of developing each area; but also (1) constant readjustment of relations between areas already in active relations: (2) the setting up of fruitful relations between the outlying centres of new settlement and the more settled regions (the more routine and well organised work of each recognised 'science'): (3) pushing out into the trackless wilderness, into regions not yet explored, regions in which superstition, 'common sense', and traditional beliefs of unknown origin still reign unchallenged.

As our analogy indicates, scientific research is of two

broadly distinguishable kinds: on the one hand, the internal work of each of the established sciences; on the other hand, the frontier work of the three varieties just now defined. The two kinds of work attract and are congenial to minds of different types. Both kinds are essential to progress. The one kind consolidates, enriches and refines the knowledge of settled areas; it is always worth while; every bit of work brings some scrap of new knowledge, new facts, new data, which are readily fitted into their proper places within the well organised system of the 'science' concerned.

Work of the other kind is necessarily more adventurous, more speculative. It is like prospecting for gold; it may bring rich rewards. But it may prove fruitless; the worker must always take the risk that his labour may be futile, either because his route proves impracticable, or because, though he strike a rich country, he may lose touch with his fellows and, therefore, have none to follow and support him, to cooperate with him, and to establish the lines of communication with the settled areas. Again, he may find that the rich land he discovers has already been reached by some other explorer along some more practicable route.

The internal work of each science goes forward with a certain steady momentum in routine fashion. The frontier work is inevitably somewhat sporadic, irregular, unsystematic. Yet it is worth while for any science to make an occasional survey of its frontiers, to draw up some report on the somewhat disreputable and doubtful activities of its frontiersmen, to attempt to afford them some guidance,

to bring to bear upon their efforts what light may be gained from a broad survey of the whole continent of science, of the relations between its various parts, of the history of the development of the whole territory.

¶ 2. PROGRESS AND ORGANISATION OF SCIENCE. Among all the areas of the continent of science, those first settled are not in all cases among the most advanced. Some centres of early settlement have remained retarded and sparsely settled and of but primitive degree of order, just because they have lacked effective contacts with other areas.

The analogy between the development of North America and the continent of science may be pushed further. Certain of the areas of early settlement developed rapidly into organised States; they fixed their mutual frontiers by lasting conventions, and joined themselves into a federation, the United States, claiming to be an organised whole, or system, of well defined parts; jealous of the formation of new States and slow to recognise them as of equal rights with themselves, and to admit them as recognised members of the organised system; insisting rather on their remaining in the inferior status of 'territories' until they shall have proved their stability, their power to maintain themselves, to grow, to enter into mutually beneficial relations with their more advanced neighbours.

Let us now apply this analogy to illumine the topic of these pages. Science began with the endeavour of the early Ionian thinkers to describe and to explain, by aid of principles of general validity, the things and processes of the

physical world about us. But it was not long before some of the more adventurous explorers entered the region which we now recognise as the territory properly belonging to psychology; for they attempted to describe and explain man and his activities in the terms and principles they were learning to apply to the physical world. Man was looked upon as one kind of natural object among others, stars, stones, plants and animals. The analytic tendency predominated, taking the form of a search for ultimate elements of which all things were composed; and man was assumed to be but a special conjunction of such elements, interwoven and playing upon one another in some specially subtle and complex fashion.

Then came Plato and Aristotle, both of whom glimpsed a truth whose profound implications were to be first clearly set forth more than two thousand years later by Immanuel Kant, and carried to its full consequences by William James in his pragmatic criterion of knowledge; the truth namely that our knowledge of the nature of man must in some sense underly, be primary to, and fundamentally a condition of, all other sciences; if only for this reason, that, while all human science is a learning to know, both learning and knowing are functions of human nature. All human science, all the science the race of men can ever achieve can, then, only be human learning and knowing; can be only the exercise of the faculties or powers of man, and is inevitably and forever relative to and conditioned by those faculties, powers, and potentialities of man. Science is, we may say, inevitably infected with the weak-

nesses and fallibilities of man and circumscribed by his limitations.[1]

¶ 3. SCIENCE AND PHILOSOPHY. From the time of Plato and Aristotle, all those who have sought to extend the bounds of knowledge have fallen into two groups: there have been those who, neglecting this truth, the relativity of all human knowledge to man's constitution, have observed phenomena and have experimented and reasoned about them in the manner most natural to man, naïvely believing that by so doing they were adding to a system of knowledge which was absolute; absolute in the sense that, though it might be extended and rectified in detail, it was capable of being perfected by just such methods as they employed. These have commonly been called, and have claimed to be, the men of science in the strict sense.

The others, those who have in various degrees taken account of the inevitable infection of all accounts of natural phenomena by the peculiarities of man's nature, have been called philosophers. Throughout the history of science, of the development of man's knowledge of the world, we find these two ways of thinking in constant conflict; conflicts not always nor necessarily barren, stimulating rather and in many cases productive of good results through the reciprocal criticisms of the two parties, the scientists and the philosophers.

[1] It is noteworthy that contemporary physicists are beginning to achieve recognition of this truth in their own peculiarly roundabout way.

¶ 4. ANTHROPOLOGY, THE SCIENCE OF MAN. At an early date, the study of the nature of man, auspiciously initiated by Plato and Aristotle, fell into a curiously unsatisfactory position between the two parties, the scientists and the philosophers. Regarded objectively, man was a part of Nature, an animal, a natural object among others, a fit object for investigation by the methods of science. From the 'scientist's' point of view, the science of man, or anthropology, was one of the natural sciences; a special branch of zoology or biology.

The development of the natural sciences culminated in the 'scientific naturalism' of the Nineteenth Century, a system of knowledge which claimed to render an account of the world of Nature complete in outline and in principle, and independent of philosophy. But it had this one very grave defect, namely, it took account of man as a material organism only. It drew a picture of the universe which, though it claimed to be comprehensive, could find no place for the mental life of man. Man's intellectual and moral powers, obstinately refusing to fit into the picture, were relegated to the realm of the supernatural; a realm which science ignored and belittled as something less than real, content to leave it to the theologians and the metaphysicians.

¶ 5. PSYCHOLOGY, THE PHILOSOPHY OF MAN. The philosophers, on the other hand, could not fail to be interested in the nature of man; the problem was of central importance for them. But unfortunately they had no effective methods

for attacking it. Each philosopher could but make some wild guess and seek to justify it by showing that it fitted into his general scheme of the universe.

However, one line of investigation, neglected by the scientists, was open to the philosophers. Science was learning to be strictly empirical and inductive; to begin its attack on objects of any one class, on phenomena of any one kind, by describing the objects or phenomena as carefully and fully as possible in general terms. Some of the philosophers proceeded to apply this fundamental procedure of empirical science to the phenomena of a class neglected by all the sciences, namely the phenomena of consciousness, of immediate experience. The processes of experiencing, of observing, of reflecting, of reasoning, of loving, of hating, could themselves be made the objects of man's observation, of his reflection, reasoning, loving, and hating; and they could be described in general terms, however difficult the task, however unsatisfactory the terminology provided by common speech. Thus there grew up, as a recognised branch of philosophy, a strangely detached little science, the science of consciousness or empirical psychology.

But it was clear that this aberrant little science, standing alone, detached both from the sciences of Nature and from philosophy, could be of little use or value. Accordingly, philosophers, on the one hand, attempted to fit it into their schemes by connecting it with their speculative guesses about the nature of the world. Some regarded these peculiar phenomena as glimpses, partial revelations to us,

of the very substance of reality. Others postulated as fundamental realities entities which they called souls, and regarded these phenomena of consciousness as functions of souls. On the other hand, scientists, concerned with man as a natural object, attempted to annex this detached little science by finding bodily organs to which these functions might be attributed as a queer kind of accessory phenomena, the so-called epi-phenomena, regarded as lawfully attached to various mechanical processes of the bodily organs but of no effect on the course of natural events.

¶ 6. GROWTH OF SCIENTIFIC PSYCHOLOGY. Such was the intolerable and ridiculous position of psychology towards the end of the Nineteenth Century. Clearly, both science and philosophy were profoundly at fault. No wonder such psychology was called by one of its greatest exponents 'a nasty little science'! No wonder it was jealously excluded from the English Universities as a pseudo-science! But, though psychology is still looked upon with doubtful eyes by most British Universities and is only grudgingly admitted to small and obscure corners of those institutions,[1] a great change has taken place since the turn of the century; the 'new psychology' has grown up.

This name, the 'new psychology', has been claimed for all psychological investigation that makes use of experimental or laboratory methods; and, again, for such as

[1] An honourable exception is the University of London, where some approach to adequate recognition and provision has been made.

relies largely on the study of mental disorders. But neither the use of brass instruments, nor the analysis of dreams, nor any other special method of investigation is the distinctive and fertilising feature of modern psychology which justifies the term 'new psychology', secures for it its present considerable vogue among the more intelligent part of the public, and causes it to be invoked in many fields of practical endeavour. The distinctive feature of the new psychology is conscious and deliberate application of all the available methods and resources of empirical inductive science in the endeavour to throw light upon the nature of man, to build up a body of systematically organised knowledge of human nature.

The problem of the nature of man, the supreme and central problem of all science, has been traditionally left to the philosophers; largely, because, as I have pointed out above, while the philosophers have for the most part had some glimpse of the central importance of that problem for all science, the scientists have been very slow to recognise that truth. But the philosophers having, in spite of their meritorious insight, conspicuously failed, during more than two thousand years of effort, to make substantial progress with this problem, are being forced reluctantly to relinquish their claim to exclusive rights in it and to admit the incompetence of their methods.

In fact, psychology, the study of man in his distinctively human aspects and attributes, is the last of the sciences to be wrested from the hands of the philosophers with their *a priori* and deductive methods, and to be constituted and organised

as one of the empirical sciences. It is going through the process of differentiation and demarcation which has resulted at various times during the modern period in the establishment of the several recognised sciences.

But, the reader may object, there are other recognised sciences which are concerned to throw light on the nature of man. There are anatomy and physiology and, especially, anthropology, all recognised and established in our academies of higher learning. How, then, can there be room for the 'new psychology'? This very proper question points to one of the major difficulties that stand in the way of the new psychology. Psychology, so long as it was merely the attempt to render a generalised description of the stream of consciousness, provoked no opposition from the scientists; it seemed harmless enough and aroused no prejudices. Not so the new psychology; with its claim to be the science of human nature, with its programme of developing, by the methods of empirical science, the theory of human nature, it excites violent opposition and strong prejudices on every hand.

¶ 7. OPPOSITION FROM PHILOSOPHY. On the one hand, it provokes the resentment of the philosophers, who cannot easily resign to science this last of all the fields of knowledge in which they have claimed to have a decisive voice and methods of achieving knowledge peculiar to themselves. For the theory of human nature has most intimate bearing upon all the problems of philosophy proper; the problems of value, relative and absolute, of correct evaluation, of

norms, of standards of right and wrong, standards of better and worse, in every sphere, in personal conduct, in politics, in economics, in æsthetic, in logic, and methodology.

These fields of enquiry together constitute the true province of philosophy; in them, though the findings of science need to be taken fully into account, science has no standing and can never displace philosophy. No matter how far science may progress, how triumphant its progress, how nearly complete the knowledge of Nature it may put at man's disposal, the truly philosophic problems will remain, demanding to be answered by the methods of philosophy. But traditionally the philosophical disciplines have been most intimately blended and confused with attempts to answer the questions of fact or existence which properly belong to science and can be answered only by the methods of science. Further, religion and theology, which have ever maintained a close alliance with philosophy, are inevitably and deeply interested in maintaining traditional theories of man shaped by themselves rather than by science.

¶ 8. OPPOSITION FROM SCIENCE. On the other hand, the new psychology provokes the resentment and the prejudices of many men of science. It is not merely that, to some of the scientists, it appears as a somewhat disturbing ally (and in some cases as competitor and intruder) which brings to the fore strangely baffling problems. More general and deeper-lying as a ground of antagonism is its inevitable challenge to certain prejudices or assumptions

widely accepted and widely regarded as the very essence or foundation of science. These assumptions hang closely together in reciprocal support and together constitute the mechanistic character which so many men of science deem to be essential to and distinctive of all science.

¶ 9. MECHANISTIC ASSUMPTIONS OF SCIENCE. Three such assumptions are of chief importance: first, that all science must describe and explain all natural phenomena analytically, that is to say, by postulating ultimate units, elements or entities of some kind (particles, corpuscles, atoms, protons, electrons, quanta, or what not), and must display all events as the conjunction and interplay of such elements or elementary phenomena. Secondly, the assumption that all science is and must be quantitative, based on exact measurements, pointer-readings, or countings of units which can be subjected to arithmetical and other mathematical manipulations. Thirdly, the assumption that teleological causation must on no account be recognised by science.

The last of these three assumptions (the most important and obstinate of these prejudices) derives support from the others; but it seems to be capable of thriving independently of them, having its own long and peculiar history in European culture.

¶ 10. MECHANISTIC CAUSATION. It is usually stated in the form of the proposition that, in science, only mechanistic causation or explanation is admissible. But, when we closely

examine this proposition, we find it impossible to discover in it any positive meaning. For what is mechanistic causation? In the days when it was possible for men of science to believe in the strictly mechanical theory of the physical world, in the billiard-ball theory, according to which all energy was the momentum of solid particles and all causation the communication of motion from particle to particle, the term 'mechanistic causation' had a definite and positive meaning; it meant just such communication of motion, momentum or kinetic energy.

The belief that all natural events were capable of explanation in terms of such causation implied the correlative belief that science has no room for teleological causation; for it was, and is, certain that teleological causation cannot be exhibited as a special case of such mechanical impact. Now, through the long conflict between science and theology, men of science had learnt to dislike teleology, of which theology has always made so much. Hence they were the more ready to welcome the strictly mechanical theory, the billiard-ball theory, of the physical world; and when, with the progress of physical science, that theory became untenable, very many still clung to the principle—the formula that only mechanistic explanation must be admitted in science—failing to see that, with the passing of the billiard-ball theory, it had lost all positive meaning, and retained only the negative implication that teleological explanation is inadmissible.

¶ 11. TELEOLOGY. To continue to assert the mechanistic

dogma as the keynote of science is to narrow and restrict quite arbitrarily the meaning of the word 'science'. Science means organised knowledge based upon observation of phenomena, and upon inference from such observed phenomena, with a modest reliance upon the uniformity and constancy of natural law and upon the validity of the principle of explanation in terms of causation (not necessarily mechanistic causation). And the sole test or criterion of science, or true knowledge of Nature, is that it shall bring us such understanding of the course of natural events as will enable us effectively to intervene and modify the course of such events for our own purposes, direct the course of events teleologically, control them in some degree (however slight) in accordance with our desires and needs.

Science is, then, founded upon teleology; and the pretence, or demand, of so many men of science that teleology must be excluded from science is utterly illusory; if it were enforced, it must be destructive of science; for it denies the foundations of all science in the nature of man.

¶ 12. MECHANISM AND TELEOLOGY. The devices by aid of which men of science seek to justify their acceptance of the mechanistic dogma (which, be it remembered, is essentially the denial of all teleological explanation and has no other meaning or content) are many and various.

One of these devices is to play fast and loose with the principle of causation, and, while making use of it, as all sciences do, to pretend that it has no proper place in

science; a pretence which the whole history of science refutes by showing that the search for causal understanding has been the very breath of science, its most indispensable and vital urge.

Another device is to define causation as mechanistic causation. At the present time this is only done implicitly, rather than explicitly; for, since the passing of the billiard-ball theory, any explicit attempt at such definition would inevitably reveal its inherent vice.

The commonest and feeblest of such devices is to meet the question as to the meaning of 'mechanistic explanation' with the answer:—'Such explanation as is given by physics and chemistry'.

¶ 13. NEO-MECHANISM AND PRAGMATISM. Far subtler and, perhaps, by reason of its subtlety, far more pernicious is a device which I may best illustrate by specific reference to one of its leading exponents, Mr Joseph Needham.[1] This learned and ingenious bio-chemist, who repeatedly plunges with much élan and gusto into the philosophy or methodology of science, has understood the pragmatic principle just sufficiently to enable him to set up a very pernicious version of it in defence of his mechanistic prejudices.

He describes his position as neo-mechanist and claims that it is accepted at the present time by a large proportion of biologists:—

"It is represented by a variety of biologists and others who all agree in regarding the scientific method as essen-

[1] *Cf.* especially his *Sceptical Biologist*, London, 1929.

tially mathematical, mechanical, deterministic, quantitative, abstract . . . and at the same time a partial, distorted, and as it were twisted approximation to truth. The neo-mechanistic position therefore, at one and the same time asserting the universal dominion of the mechanical sort of explanation over all nature, living and non-living, and admitting the inadequate nature of this sort of explanation as a full account of the world, resembles the old mechanisticism in maintaining the heuristic need for the machine [that is, for the assumption of a purely mechanical universe] and differs from it in seeing nothing solely ultimate about the machine. It thus recognises itself to be the way the scientific mind goes to work".[1]

Thus, while the old-fashioned mechanists believed that their mechanical account of the universe was substantially true, in outline at least, the neo-mechanist resigns all such pretensions; he recognises that his mechanical account is 'a fiction', one fictitious account among others, the philosophical, the religious, the poetic, etc.; but a fiction as good as any other, and one which the man of science prefers in virtue of a peculiar 'mental twist'[2] from which he suffers. "That the mechanistic universe was the real universe, we should not attempt to believe". For "it is a mistake to suppose that there is anything really corresponding to either teleology or mechanism in external nature".

[1] *Op. cit.* p. 204.

[2] *Op. cit.* p. 220. We are not told whether this 'twist' is congenital or acquired. As a psychologist I incline to the latter view; but it would seem that in the author's opinion the twist is congenital; for he tells us that men of science "are born and not made" (p. 251).

Again: "It is certainly undeniable that science abstracts, generalises, analyses, and constructs a picture of reality quite unlike that reality itself".

The man of science, we are told, works very largely "by non-rational means"; "operates to a high degree unconsciously, as it were, like the builders of coral reefs": is guided by 'intuition', by 'a sure instinct' and, I suppose, by his peculiar 'mental twist', rather than by reason. Scientific procedure being so largely irrational, the product of 'intuition' and of a 'sure instinct' and of 'mental twists', we may not hope to reform it, however distorted, inadequate and absurd the conclusions to which it leads: "Clearly you cannot meddle with the scientific method, as so many reformers have tried to do; it is the outward and visible sign of one of the ways the mind works, and the fact that it always issues out into mechanism may be deplored, but must be accepted".[1]

Throughout the book we find repeated again and again such assertions as: "The mechanistic conception of living organisms is necessitated by the fact that science is, above all, a system of measurement"; and "the atoms of Lucretius are the life-blood of science, and determinism the only air which it can breathe. That is its peculiar constitution; it cannot be otherwise". The only grounds suggested for our acceptance of such assertions of necessity are two. First, that science always has been like that (which is not

[1] *Op. cit.* p. 84. The reader should note how our mechanical philosopher appeals to psychology (a crude and arbitrary psychology invented *ad hoc*) for the justification of his dogmatic negations.

true). Secondly, that ninety per cent. of contemporary biologists are mechanists (new or old); which is perhaps true, but hardly a compelling ground of acceptance.

Could anything be more perverse and absurd than this neo-mechanistic dogma, the modern substitute for the old-fashioned mechanism?

Misunderstanding the pragmatic principle, it gives up the notion of truth entirely; and, recognising that its account of the world is partial, distorted, inadequate, a picture utterly unlike the world it pretends to depict, it claims to be a necessity to men of science just because their peculiarly 'twisted' minds work that way. In short, as a great poet has said: "There are nine and sixty ways of reciting tribal lays, and every single one of them is right". One account of the world is as good as another; because all alike are mere fictitious, fanciful pictures, among which you choose according to your taste, your mood of the moment, the particular occasion and circumstances of your discourse.

But the man of science has no choice; he, and he alone, *must* believe that man is a machine (Needham's favourite assertion) because he is inclined to that view by the inborn 'mental twist' without which he would, by definition, not be a man of science. It is a modern attempt to justify the old compartmental working of the mind which has been characteristic of so many scientific men, of all those who, though they accepted universal mechanism on weekdays, were orthodox Christians on Sundays.

¶ 14. ADMISSIONS OF NEO-MECHANISTS. However, there are instructive features of this neo-mechanism. First, its admission that the mechanical account of the world is false. Secondly, its admission that adherence to this way of thinking expresses merely a deeply rooted prejudice, a 'mental twist', which it regards as a necessary qualification for scientific work. Thirdly, its utter failure to find in the course of the ten essays of this volume or elsewhere, any justification for admitting to the tyranny of this 'mental twist'.[1] Fourthly, the fact that, in the course of the many twistings and turnings of its attempted self-justification, it repeatedly falls back upon psychological considerations.[2]

Fifthly, Needham's defence of neo-mechanism has a certain value as illustrating a common misunderstanding of the pragmatic principle, a misunderstanding common to many who reject the principle with virtuous indignation as

[1] If there be any attempt more successful than Needham's I am unacquainted with it. The only other contemporary elaboration of the doctrine familiar to me is Dr. Lloyd Morgan's, which I have examined at some length in my *Modern Materialism and Emergent Evolution*; London, 1928.

[2] Not upon a psychology that makes any attempt to be scientific or consistent, or in any way thought-out, rather, despising or ignoring, in accordance with a common practice, what systematic knowledge of the mind's working has been attained, it relies upon psychology of the crudest kind, the psychology embodied in common speech, appealing to mysterious intuitions and *sure instincts* and peculiar *mental twists*, all merely undefined popular expressions, so utterly vague as to be as nearly as possible meaningless.

well as to those who, like this author, accept and make use of the principle in a perverted fashion which, if it were a true application of William James' pragmatism, would justify all the moral indignation of its opponents.

It is essential to our discussion that we—my readers and I—avoid this common misunderstanding and recognise the true place and function of the pragmatic principle. This question of the validity and application of the pragmatic principle is a leading example of the many frontier problems of psychology; and the valid answer to it must be agreed upon before we can profitably discuss other great frontier problems. For it is the central problem of the theory of knowledge and intimately concerns all discussions of the validity of scientific procedures and of the proper relations between the various sciences and between science and philosophy.

CHAPTER II

THE PRAGMATIC PRINCIPLE FUNDAMENTAL TO ALL SCIENCES

¶ 1. SCIENTIFIC OBSERVATION. Science, or systematic knowledge of the nature of the world, is based upon observation; but such observation is not necessarily experimental, nor yet quantitative, observation, as many exponents of the mechanistic principle (both the old and the new) assert. Some of the well-established sciences are based mainly upon observations that are neither experimental nor quantitative; though it is true that, in so far as observation can be made experimental and quantitative, the science is the more surely founded and more capable of further advance.

Geology is a notable example of such a science; much systematic knowledge of the earth's crust was obtained through observation that was neither experimental nor quantitative; and such knowledge was and is useful in an eminent degree. It has rendered possible predictions which, though attaining only modest degrees of probability, have been and are very widely used as guides to action. When the mining engineer sinks a shaft or a bore hole in search of gold, coal or oil, he is guided by predictions as to what he will find by boring at certain spots and to certain depths; and such predictions are always infected with uncertainty, often of high degree.

Biology is another such science. The mechanists incline

to assert that, until experimental and quantitative observation became largely used in certain of its branches, biology did not deserve to be called a science, and was more properly to be called mere natural history. Yet one man did more than any other to develop mere natural history into science, namely Charles Darwin. The vast majority of the observations on which Darwin relied were neither experimental nor quantitative, and, when quantitative, they involved only very rough measurement or simple counting, as of the number of vertebræ in a bird's neck or of petals in a flower. Much the same may be said of the epoch-making work of Pasteur.[1]

Nor can it be said that the observation on which science is founded is necessarily observation of matter, or of material or physical events or processes. Nor, again, can it be said that the observation must take the form of sense-perception. Observation is of phenomena or appearances; and what it is that appears is, in each case, a further question, often a most subtle and difficult one.

¶ 2. SCIENTIFIC RECORDING. After observation the next step in science is to make some record of the phenomena or appearances observed; and the more accurate and full the observations and the records of them, the better. But the most accurate and full observations and records of observations do not in themselves make science. Photo-

[1] As also of J. B. Lamarck, Charles Bell, Hugh Miller, Johannes Muller, Charles Lyell, E. D. Cope, A. R. Wallace, E. B. Tylor, T. H. Huxley and many others.

graphy is now much used in many sciences as a method both of observing (indirectly) and of recording phenomena. But the most elaborate series of photographs (even kinematographic) does not constitute science.

¶ 3. SCIENTIFIC INTERPRETATION. Science does not begin to take shape until we begin to interpret the phenomena. Some years ago I made many moving pictures of racoons solving problems, especially of a racoon deftly turning a series of twenty-four interlocking latches, thus unlocking and opening the lid of a box in which he found food. Now, no multiplication and refinement of such photographs (though it might be a well-nigh perfect record of these events) would constitute science; not even if every twitch of every muscle were thus recorded.

Most commonly our observations are recorded in language; as soon as we make this step, we begin inevitably to abstract and to generalise the concrete particular phenomenon as such, to regard it as an instance of a general type, an object or event of a general kind or class. For it is of the very essence of language that it abstracts and generalises; in verbal description we inevitably neglect certain aspects and features of the concrete phenomena, namely those which seem to be irrelevant to our purpose, and we accentuate and emphasise those aspects and features which we regard as relevant to our purpose.

All verbal description thus inevitably involves interpretation, purposive selection and classification. If you say: 'This is a flower', you interpret the observed phe-

nomenon as signifying an object of a familiar kind to which you impute a multitude of properties previously observed (by yourself or others) in many other flowers.

In truth, the mere act of perception commonly involves such imputation or implicit attribution of properties. If you merely say: 'This is an oval patch of yellow colour', even then you are exercising, in less degree, the same functions of abstraction and generalisation; you assume as known the general meaning of the words 'oval', 'yellow', 'colour', and the like. The very word 'is' has a meaning which may be endlessly discussed. The meaning-function of each word consists essentially in this; that the word, on being uttered, implies in him who utters, and evokes in him who hears and understands or appreciates its meaning, certain expectations. And in the sentence: 'This is a flower', the meanings of the several words reciprocally modify and restrict one another to yield a more specific and definite meaning.

¶ 4. SCIENTIFIC TRUTH. Now what do we mean by saying that the sentence or proposition, the verbal description, is true? Suppose the proposition to be: 'This flower has five petals'. The hearing of the proposition evokes the expectation of finding five petals. You count the petals, you find five, your expectation is satisfied, and you say you have verified the proposition; the description is true because it *corresponds* to the reality, the objective fact.

In all scientific description we endeavour to make our description *correspond* with reality, in just this sense. If

you take up a small animal and say: 'This is an echinoderm', you evoke in those who understand your remark certain definite expectations. And, if they find upon observation that your description *corresponds* to the nature of the object, the truth of your remark is verified.

In such simple instances we have the foundation of the *correspondence* theory of truth; a proposition is true when its meaning (the expectation it evokes) corresponds to the facts, to the objective reality, to the state of affairs which it purports to describe; it is verified when the expectations it evokes are satisfied by observation.

Now in many cases we cannot hope to verify the proposition by direct observation; as for example in the case of all propositions descriptive of past events. What does 'true' mean in such cases? It means that the description is such that, if we had the opportunity to observe the thing or event described, we should be able to verify it, to find that it corresponded to the event.

¶ 5. THE PRAGMATIC PRINCIPLE. It is here maintained that the correspondence theory of truth is the valid theory. It states the only intelligible and tenable meaning of the word 'true'. It is, in reality, accepted by all men, with rare exceptions among over-sophisticated persons befuddled by indiscreet philosophising. Yet the critics of pragmatism commonly attack the principle on the ground that it rejects the correspondence theory of truth, alleging that it sets up a different theory of truth, proposes to give a new and quite different meaning to the word 'true'.

The pragmatist, they say, proposes to call true every proposition that serves his purposes, that aids him in attaining what he desires; and, if his purpose is merely to attain to peace of mind or to comfortable beliefs in matters where verification or ascertainment of correspondence is difficult, then he simply exercises the will or the desire to believe, accepts whatever propositions are most pleasing to him, or prefers among possible alternatives that one to which he naturally inclines in virtue of the inborn or acquired peculiarities of his make-up; thus indulging a common human weakness which has been the source of an immense amount of error and untruth.

Now the procedure against which this crushing criticism is directed is a pernicious misapplication of the pragmatic principle; just such misapplication as is illustrated by the neo-mechanistic doctrine. What, then, is the valid pragmatic principle? And how does it lend itself to such misinterpretation and perverted application?

The pragmatic principle does not pretend to assert a new theory of truth. It accepts the correspondence theory of truth; but, recognising that in only the most simple instances, as when we state in words observations which involve only simple counting of well defined entities (such as 'this flower has five petals'), do our verbal descriptions correspond closely and adequately to the facts described, it raises, not the question of the nature of true propositions, but *the question of the criterion we must apply* in seeking to ascertain whether a proposition is true, whether it does or does not correspond to the facts described.

¶ 6. THE TOUCHSTONE OF TRUTH. This problem of the criterion of the truth of a proposition is commonly overlooked by the adverse critics of pragmatism. Yet it is the all-important problem of the theory of knowledge. It may seem to the reader at first sight that the answer is easy enough. A proposition raises in your mind an expectation or a question. With this in mind, you go to Nature and make the relevant observation; you count the petals of the flower, or the limbs of the animal, or the facets of a crystal, about which some numerical proposition has been made; in so doing you find that the proposition does, or does not, correspond to the facts; and you call it, accordingly, true or untrue.

But suppose the proposition to be a little less simple, less easy to verify by simple and direct observation, even though it be perfectly concrete and specific, *e.g.*, 'This pebble is of quartz'. Again the proposition rouses in those who have some knowledge of quartz, who know something of the meaning of the word 'quartz', certain definite expectations or questions which can be put to the test of observation. Can you scratch it with your penknife? If so, it is not quartz. If you cannot, one expectation raised by the assertion is satisfied and *in so far* the proposition is verified.

In this case we begin to glimpse the meaning and function of hypothesis. On seeing the pebble you are uncertain of its nature. You put forward the surmise: It is perhaps quartz. And, if you desire to know whether this surmise, this hypothetical proposition, is true or corresponds, you

must take some action beyond *simple* observation; you must put it to the test of *experimental* observation. With each experiment that satisfies an expectation founded in a knowledge of the meaning of the word 'quartz', your verification becomes stronger; and at some point of this process you stop, satisfied that your surmise was true. With the attainment of satisfaction of each expectation evoked by the proposition, your confidence in the truth of the proposition is raised to a higher power, the probability that it is true becomes greater; and you carry the process of experiment to a point of verification, of probability, corresponding to the strength of your interest in the problem of its truth.

All observation involves action, though this is more obviously true of experimental than of simple observation; and all action is motivated and expresses some purpose. In scientific observation the purpose is to test or verify some surmise, some hypothetical proposition; the motive is the desire to know the truth; though this may be complicated, perhaps most detrimentally, by other desires, such as the desire to prove that I am right and you are wrong. And the purpose of the action, which is the observation (simple or experimental), being to test some surmise or hypothesis, the conditions of observation are so chosen or arranged that the act of observation will achieve the foreseen result, the end proposed, the goal aimed at, intended and purposed, if the hypothetical description is true, *i.e.*, if it corresponds to the state of affairs in which our action (our observation) intervenes. If, then, our act

of observation directed by our hypothesis attains its goal, the satisfaction of our expectation, we regard the hypothesis as strengthened.

¶ 7. PHYSICS TRIBUTARY TO PSYCHOLOGY. It is only very recently (through the formulation of the Heisenberg principle) that the physical scientists have realised the truth that observation always is, or involves, our active intervention in the course of the events observed. For the physicists, having nothing but contempt for psychology, learn only through rectifying their own mistakes in their own way. In this case the general truth that observation is always active intervention has been brought home to the physicists by way of the special case of visual observation of the place and motion of the minutest physical entities; for such observation (whether direct or indirect through photography) requires that the objects concerned be illuminated; and to illuminate is to throw rays of light upon them; and the incidence of rays of light upon them must affect them and their movements.

¶ 8. CRUCIAL EXPERIMENTS. In some cases it is possible to devise the *crucial experiment*. We have two rival hypotheses; and it is possible to devise conditions which can be chosen (as when the astronomer waits for a particular conjunction of conditions such as are provided by an eclipse) or arranged, such that the result of our observation satisfies the expectations of the one hypothesis and fails to satisfy the expectations of the other. In such cases the

decision, as between the two rival hypotheses, may conclusively show the superiority of one to the other.

But the most decisive and successful *experimentum crucis* is never conclusive in any absolute sense. It always remains possible that a still better hypothesis may be formulated, one which will correspond still more fully and completely to the facts; one which, therefore, will be a better guide to action in dealing with facts of that kind.

¶ 9. "TRUTH IS FOR ACTION". In science, then, a truth is a true proposition; a true proposition is always the statement of an hypothesis which has been proved to *correspond* in some measure with the facts, has guided us to action which succeeds in satisfying the expectations raised by the proposition. The more of such expectations the proposition has raised and has satisfied through such guidance, the more confidence we may properly feel that it does correspond with the facts. When it has thus satisfied all the more obvious expectations, without failure in any case, we regard the hypothesis as a well established theory. And, if we are incautious, we may go on to claim that it expresses an absolute truth. But to do that is to overlook the indisputable fact that every verbal statement is inevitably abstract in some degree and therefore inadequate to the complexity and fullness of the concrete reality. This again the physicists have recently begun to realise for themselves. They have grasped the truth that every event is in active relations with all others, and that, therefore, a completely true account of any part of the whole universe of events must involve, must

be a part of, a description of the whole in all its parts, such an account as is and must for ever be hopelessly beyond the powers of man.

¶ 10. ABSOLUTE TRUTH. Thus the pragmatic principle forbids us to believe that our descriptions and interpretations of events can ever be absolutely true, can ever correspond completely to them in their concrete reality. Yet a proposition that purports to be a simple description of a particular concrete event may approximate to what we believe to be absolute truth. If you see an apple fall from the branch and say: 'That apple fell to the ground', the description may without serious error be accepted as true; but it is of very little interest; it is, standing alone, of no value as a guide to action.

It is as guides to action that propositions are of value. And it is in proportion as propositions are of general import that they are useful as guides to action. Thus the proposition that all ripe apples eventually fall from the bough is one of considerable value as a guide to action. But in generalising the proposition—in jumping from the description of the particular instance to a generalised assertion—we have introduced a vast uncertainty. Our description of a concrete particular event is replaced by a generalised proposition which includes future as well as past events and can never attain to more than probability of a limited degree.

You have observed a great many ripe apples, every one of which without exception has fallen from the bough;

you make the *induction* that all ripe apples fall from the bough if not prematurely removed, with a probability that is greater, the greater the number of observed instances. But, you may say: 'Suppose one has observed the fall of one thousand apples in turn, surely one may then make an absolutely true general statement about them. All these thousand apples have fallen'! Well, in the first place, the statement is not a general one in the true sense of the word 'general'. It is rather a collective statement. It affects not all apples, but a sum or series of particular concrete instances, these thousand apples. Further, how are you to establish the truth of your statement? The question is one of historical truth.

¶ 11. HISTORICAL TRUTH. It is in relation to questions of historical truth that the validity of the pragmatic criterion meets the most obstinate opposition. The question becomes one of the validity of testimony, a purely psychological problem. Everyone knows—the psychologist best of all—the uncertain quality of all human testimony. If the statement about the thousand apples is to be accepted as true, we have to assume (1) accuracy of observation, (2) accuracy of counting, (3) accuracy of memory and (4) accuracy of statement of what is remembered. The testimony may be invalid at any one of these stages owing to any one of various failures or imperfections of the mental processes involved, even if the *intention* of the subject is to observe, count, remember, and report with complete accuracy.

The same possibilities of error are there even if the statement concerns only some single simple event, such as the fall of a single apple (with the exception of the counting process). What then is the criterion of truth in such cases, the cases of description of past events? Clearly there is no other criterion than the pragmatic one, difficult and unsatisfactory as the application of it may be. How am I to test the truth of your statement? I can make a psychological investigation and try to form an opinion of your trustworthiness as observer, rememberer, reporter; and I can look for effects which I may infer, rightly or wrongly, must have followed from the event recorded.

In both cases I am committed to a train of action directed to the attainment of such effects as I am led to expect by the hypothesis that you are speaking the truth. And notice that the more concrete and exact the statement (*e.g.*, 'This apple fell on this spot five minutes ago') the greater the probability of error in it. And, on the other hand, the less exact and concrete the statement, the more difficult is it to verify it through investigation of probable consequences. Suppose the statement to be: 'Something fell near me a little while ago'. How impossible to verify by investigation of physical consequences! And if the statement take the form: 'I thought something fell'; then investigation can only be psychological; since the statement made is purely psychological, a report which makes claim to truth only in the mental sphere.

¶ 12. HOW WE BELIEVE. In actual practice we commonly

meet the problems of historical truth as best we can (in so far as we do not accept such statement merely through 'suggestion'), by means of one or both of two expedients; we may multiply the sources of testimony and consider the historical statement to be more credible the more persons testify to it; and we may investigate the trustworthiness of the persons concerned. The former can effect but little, in view of the facts of mass-suggestibility. The second is a difficult and delicate process, involving the weighing of many probabilities. In conjunction the two methods may, in favourable instances, lead to a verdict of high probability; so that if you ask me: 'Do you believe that Charles I was beheaded'? I am able to reply: 'I think the statement is probably true; the probability that it is true is far greater than the probability that it is untrue; and, if occasion should arise, I will accept it as a guide to action'.

In this connexion let the reader reflect on the difficulties of legal testimony, on the evidence for the sea-serpent and for the Angels of Mons, on the controversy over the Bible miracles, on that over the alleged supernormal physical events reported by thousands of honest 'spiritualists'.

Let us be clear about this. If Cæsar crossed the Rubicon, then the statement that Cæsar crossed the Rubicon is true. Pragmatism does not deny it. It merely asserts that, as with all other propositions, the truth, the correspondence with fact, can be established (not with certainty but only with some degree of probability) only by investigation; that to investigate is to apply the pragmatic criterion, is to look for such consequences as are implied by the acceptance

of the proposition; and that we are properly led to regard the verification as the more satisfying, the greater the number of the expectations that are raised by the proposition and are satisfied in the course of the activity of investigation to which we are guided by acceptance of the proposition.

Consider the case that ten solid respectable citizens testify they observed a living man rise six feet in the air and remain there for five minutes without any discoverable physical support. Clearly the question arises: 'Is the statement true'? And you may investigate in many ways. You may ask for a detailed independent account of the incident from each of the ten men, and may compare their accounts. You may take each one of the ten to your laboratory and there investigate his powers of observation, remembering and reporting. You may look into their motivation, their antecedents, their reputations, and the peculiar suggestive influences brought to bear upon them at and before the time of the alleged incident. Not until such investigations have satisfied the reasonable expectations aroused by the assumption that some or all of the witnesses are credible in the particular circumstances, are you called upon to regard the statement as having a fair degree of probability, such probability as would justify the expenditure of time and energy in attempts to observe a repetition of the alleged phenomenon, or in attempts to explain it.

¶ 13. DEGREES OF PROBABILITY. Are there, then, no

absolute truths in the sphere of physical existence and events? The answer is that there may be, but we have no means of proving that any such proposition is absolutely true. We can only achieve various degrees of probability, and that only by the pragmatic procedure.

We can, of course, formulate propositions which are true because tautological and conditional, or true by definition. If Cæsar was a man who crossed the Rubicon, then it is true absolutely that Cæsar crossed the Rubicon.

There we enter the sphere of logical truths; all of which are in a sense tautological, depend upon definition and are conditional. If a triangle has by definition three, and only three, angles, then every triangle has three, and only three, angles. And if the axioms of Euclidean geometry are true, and their meanings quite definite and quite unequivocal, then various propositions of such geometry may be deduced and regarded as true *on those conditions*.

In this class fall all the truths of arithmetic and mathematics. We cannot transfer these from the ideal realm to the physical, without reducing them to mere probabilities; as when we add two to two in the form of drops of water, and find they make, not four, but one. The difficulty is that in the physical realm we can never define our objects completely, since our knowledge of them is always incomplete.

¶ 14. MORALS AND ÆSTHETICS. How then about the other great realms of value, the realms of morals and æsthetics? These are largely responsible for the dislike of pragmatism

shown by so many philosophers. Most philosophers shrink in horror from the proposition that there are no absolute truths in these spheres. They will have it that some moral and æsthetic judgements are absolutely true, that (in spite of Bentham) great poetry is better than push-pin; that Florence is more beautiful than Manchester; that we ought to try to be just in all our dealings with our fellow men; that wanton cruelty is reprehensible; that Marcus Aurelius was a better man than Nero. All these, we may admit, are indisputable propositions; and they cannot be verified by any pragmatic test. Here, then, we are dealing with realms of 'truth' which fall outside the sphere of pragmatism.

¶ 15. FACTS AND VALUES. The difficulty here raised is a matter of terminology; we ought to solve it by differentiating our terminology; we ought to recognise two distinct meanings of the word 'true' as applied to propositions, judgements and the beliefs we arrive at by judgement. Instead of using the word 'true' (or truth) in the usual and traditional undiscriminating fashion, we might, with great advantage to clarity of thinking, confine the adjective 'true' to propositions, judgements and beliefs regarding the reality of existences and events, and might apply some other adjective such as 'valid' or 'sound' to characterise those concerned with values.

We might well go further and say that of judgements of these two kinds—judgements of fact and judgements of value—the former result in true or untrue beliefs, the

latter in sound or unsound (valid or invalid) opinions. The pragmatic principle applies only to the former, the realm of knowledge or belief; and does not apply in the realm of value or opinion.

Could this distinction between knowledge and sound opinion, between truth and validity, always be observed? And would the observance of it obviate completely the prevailing confusion? Are there not propositions that would refuse to fall clearly within one or other of the two classes? Suppose you say: 'I like this jam', or 'I prefer this wine to that', or 'I love you', or 'All men are pleased by praise'. Clearly, all these propositions are, or claim to be, statements of fact. Are they not also concerned with values? They concern experiences that may lead to judgements of value; but they do not assert values or embody valuations. And, being statements of fact, they are subject to pragmatic valuation; pragmatic tests may be applied to each such proposition, though such tests may be difficult and inconclusive.

Suppose, then, you say: 'This jam is good'. Is that not virtually identical with the proposition 'I like this jam'? And is it not an assertion of value? Here we have a difficulty due merely to laxity of common speech and thinking. When we say 'This jam is good', we commonly mean merely to express our liking for the jam, or the fact that the eating of it is pleasant to us; and we ought in strictness to use some such form of expression, an expression of psychological fact, rather than any form of words that expresses a judgement of value.

The distinction appears clearly, and its importance is obvious, if we make similar propositions in a less trivial sphere. If for example one says: 'I like this man', it is clear that one does not assert him to be a good man; for one may well say: 'This is a bad man, but I like him'; or 'He is not a good man, yet I cannot help liking him'; or 'He is a pleasant fellow, but a rascal'; or 'A poor thing but mine own'.

¶ 16. THE REGION OF VALUES. The realms of value are among the most important of the frontier regions we have to survey. Here we touch upon them only in so far as necessary to clear up the confusion concerning the pragmatic principle. At a later stage of our discussion we must return to examine the view (maintained by some) that there is no essential difference between what we are here distinguishing as knowledge on the one hand, valid opinion on the other, or as truth and validity.

CHAPTER III

SCIENCE AND PHILOSOPHY

¶ 1. SCIENCE AND PHILOSOPHY. Assuming for the present the validity of the distinction we have drawn between true statements and valid opinions, we may note, as a further point in its favour, that it enables us to draw a clear line between science and philosophy in a manner consistent with good and well-established usage. A man's philosophy is, we commonly recognise, something quite distinct from his scientific knowledge; he may have much of the one and little or nothing of the other. Philosophy is a matter of wisdom, science a matter of knowledge. The wise man, the philosopher, is he who has sound opinions about the relative values of all things; who has, by much experience and reflection upon values, achieved a sound and harmonious system of values, of standards, of norms. He has sound opinions as to what is most worth doing in the sphere of personal conduct; as to what is most desirable in the sphere of politics; as to what is most worthy to be enjoyed in the æsthetic sphere; as to what is most fruitful in the sphere of methodology and logic. In each of these spheres he can judge by the aid of his standards, what is good, what is less good, what is bad. Of course, knowledge is useful and is indispensable for wisdom; yet a man may have much knowledge of a high scientific order, and yet have little wisdom, little power of sound judgement in the realm of value. Only a philosopher's reflection, working

on a basis of knowledge, can build up a sound philosophy.

There is much confusion and difference of opinion on this question of the proper distinction between science and philosophy; and it is in fact a matter of convention. But one convention may be better than others, more conducive to clarity and fruitfulness of thinking in both science and philosophy. I, for one, am convinced that the convention here defined and advocated is the best and is destined in the end to supplant its rivals.

Of those rivals two are widely accepted. According to one, well represented by the 'synthetic philosophy' of Herbert Spencer, philosophy is the system of knowledge which is achieved by attempting to combine or synthesise the knowledge embodied in all the sciences in one comprehensive description and interpretation of the universe. This has the very grave defect that it ignores the very important distinction discussed in the preceding pages, the distinction between judgements of fact and judgements of value; its exponents either ignore the problems of value and valuation completely, or they assume (illegitimately as we have seen) that science can completely replace philosophy, that a sufficient knowledge of fact will automatically solve all problems of value.

The other rival convention (and this is one of long historic growth) professes to recognise two kinds of knowledge or truth, two very different descriptions and interpretations of the universe, the scientific and the philosophical; it professes that philosophy (or, for this convention, metaphysics) has some method other than the

scientific method for achieving a true account of the universe. And it is content to recognise both systems of knowledge as true, even though they be very different and actually inconsistent with one another.

This convention is adopted not only by metaphysicians (who for the most part regard some one metaphysical system as a system of truth superior to the scientific system) but also by some men of science; these, unlike most of their fellow scientists, cannot quite bring themselves to repudiate philosophy completely, to reject it as a mere tissue of fanciful speculation; they feel that philosophy has some proper field of activity and something of importance to say, but they do not know how to define that field.

This convention and this attitude of men of science toward it is well illustrated in the book we have had occasion to criticise on earlier pages. Again and again the author tells us directly, or by implication, that the account of the world given by science is necessarily and inevitably mechanical and materialistic and cannot admit any events to be teleological, while the account given by philosophy is largely teleological; that nevertheless both accounts must be accepted.

This supposed reconciliation of the rival claims of science and metaphysic is achieved at a ruinous cost. If we put aside the difficulty that arises from the fact of the existence of many very different and utterly inconsistent accounts of the universe, each of which claims metaphysical truth, we cannot accept it for the very good reason that it entirely abolishes the notion of truth. Science and meta-

physic are given an equal status; for both are fictions. Under this system, the contention of pragmatism that we cannot hope to achieve an absolutely true account of the world of things and events, absolutely true knowledge, is accepted; but, in accepting it, the exponents of the system overshoot the mark and fall into the abyss of absolute scepticism or pyrrhonism; they imply that we cannot hope even to approximate to truth (in the sense of the correspondence meaning of 'true'). For both science and philosophy are merely games with which we amuse ourselves; fictions which we build up, as the novelist writes a story, or as a paranoiac patient elaborates a marvellously consistent system of delusion, in obedience to some obscure impulse of which he has no understanding and no control; and any proposition may be called true so long as it is consistent with the conventional rules of the game we happen to be playing. Both science and philosophy, and religion as well, have been 'subjectivated'; all having been reduced thereby to the level of mere fictions, there can be no further conflict between them.

Such pyrrhonists as Needham commonly neglect to tell us what the word 'true' means for them. But it is clear that, for them, its meaning can only be that of the consistency-theory of truth, according to which any fiction is true so long as it all hangs together consistently.

¶ 2. ORIGIN OF THIS VIEW. This wholly unacceptable way of dealing with the rival claims of science and of metaphysic to give true accounts of the world is the product

of a long historical process. Aristotle, besides writing about the various realms of Nature, produced treatises upon the mind and its working, upon logic and theory of knowledge, and upon morals. When later students arranged and classified his work, they put together the volumes dealing with the various classes of material or physical things and called them treatises on physics; and they placed after them those other volumes and called them the *after-physical*, or the *beyond-physical*, treatises on things that come after physics or are beyond physics, the *meta-physical*.

It is not clear whether the term was designed to express merely the spatial sequence of the volumes, the temporal order in which they might best be studied, or the logical relations between them. Probably there was some confusion of these three meanings. However that may have been, there came into vogue a distinction between man and Nature. Men, or at least the souls of men, and all other mental beings, gods, demons, angels, and the like, were regarded as super-natural and, as such, were contrasted with the natural or physical. The natural realm was then gradually claimed as the proper sphere of science; while the super-natural or metaphysical or mental or psychical or spiritual, the world of spirit, was left to metaphysics and religion; but, while the men of science strove to exclude metaphysics and religion more and more from their realm of Nature, the metaphysicians and the theologians were not content to be confined to the super-natural realms and continued to claim to have means of attaining knowledge of the natural, a kind of knowledge superior to, or at least

equal to, the knowledge produced by natural science. This claim is admitted by the school of scientists for whom Needham speaks; but, as we have seen, at the cost of reducing all lore and learning of both kinds to the status of pure fiction.

¶ 3. PRAGMATIC DISTINCTION OF PHILOSOPHY AND SCIENCE. It is not to be believed that either science or philosophy will be content with this lame attempt at reconciliation, so ruinous to the claims of both to attain to truth. The division between science and philosophy advocated in these pages clearly separates their provinces; the province of knowledge of fact, of propositions which can be brought to the pragmatic test, can be used as guides to action, and thus shown to be relatively true (or untrue), to correspond sufficiently closely to the facts to be useful guides (or useless or misleading guides) this, the province of science, is separated sharply from the province of wisdom, of values and valuation, of valid principles and sound opinions, of standards and norms of right and wrong, of better and worse, of higher and lower, the province of philosophy.

This separation, dictated by the pragmatic principle, holds the balance true between science and philosophy. It is acceptable to the man of science; for it does not recognise a rival method yielding rival truths, a knowledge of fact different from, and perhaps in conflict with, the truth attained by his own methods. It is acceptable to the philosopher; because it secures to him a realm of the first

importance from which no advance of science can dislodge him; and because it gives him, in a sense, a whip-hand over science, gives him the last word upon the validity of the methods of science: for the pragmatic principle itself is a principle of philosophy, of methodology, of theory of knowledge or epistemology.

It is the very essence of the pragmatic principle that it subordinates truth to value, and thus puts science under the rule of philosophy; teaching, as it does, that we can recognise the degree of truth, of 'correspondence', of any proposition only by discovering its degree of value as guide to action.

Further, the whole history of science and of its gradual separation from philosophy points to the validity of the principle of separation or demarcation here adopted; and that in two ways. First, it shows the gradually increasing practice and recognition of the pragmatic principle within science, the increasingly clear and explicit reliance of science upon hypothesis and the verification of hypothesis by experimental observation. Secondly, it shows how, so long as knowledge of any realm of fact was vague and primitive, confused as to method and relying in part on deduction from alleged *a priori* truths, it continued to be regarded as part of philosophy; and became detached as a branch of science in proportion as it relied more exclusively on the pragmatic method.

¶ 4. PRAGMATISM—A CAVEAT. In accepting the pragmatic principle, allowing it to dictate the line of demarcation

between science and philosophy, and giving it supreme and undisputed sway within all branches of science, the mental no less than the physical sciences, we must avoid an error which is common to many modern text-books of philosophy and to many men of science; namely, the error of representing pragmatism as a system of philosophy. The writer of the text-book of philosophy, after invalidly setting up pragmatism as a system of philosophy, proceeds to knock it down again. On the other hand, the man of science who makes the same error is apt to claim supreme jurisdiction for the pragmatic principle not only in science but also throughout the sphere of philosophy, thus professing to annex the whole realm of values to science and to throw philosophy into the discard. The claim naturally provokes strong resentment on the part of the philosophers, and perpetuates the ancient and unnecessary quarrel between science and philosophy.

Let us briefly examine this false claim of the too aggressive scientist to apply his pragmatic procedure in the realms of value. In the æsthetic realm he can hardly find a footing. It would be too obviously absurd to say: 'This is beautiful because it is useful, because it leads to successful action'. It is in the sphere of morals, of conduct, that he can and does seem, to himself, to make out a plausible case. There is plausibility about the proposition: 'Honesty is best because it is the most useful policy'.

¶ 5. INTRINSIC AND INSTRUMENTAL VALUES. Clear thinking about this question requires that we hold fast to the

important distinction between two kinds of value or goodness. There is, on the one hand, intrinsic value or goodness; and, on the other hand, instrumental value or goodness, value as means to the attainment of some good. In the sphere of art we should not call a paint-brush beautiful because it is a useful means to the production of a beautiful picture; but we may call it, for that reason, a good brush; it has instrumental value. Propositions asserting instrumental value can be and must be subjected to the pragmatic test. You can test the goodness of the brush by making use of it in painting your picture.

Similarly, in the sphere of morals (and in the hardly distinguishable spheres of politics) a certain type or quality of action or of character may have instrumental value. Thus, honesty may be valued on the ground that it makes for the prosperity of the community. In so far, then, as the value of honesty is instrumental, it is subject to the pragmatic test; and the proposition, 'honesty is good as a means to prosperity', may be said to be a scientific hypothesis, which is either untrue or in some degree true; for it is equivalent to the proposition 'honesty contributes to prosperity', and takes for granted the value of prosperity, the validity of the proposition that prosperity is a good. But the validity of the latter proposition is a proper question for philosophy.

In this case the value-proposition may seem to be almost tautological and to require, therefore, no philosophical enquiry. But this is by no means the case with all propositions of value. Suppose the proposition to be 'Social

order is of greater value than social liberty'. Here we have a proposition which cannot be verified pragmatically; it is a question of opinion rather than a question of fact; essentially, intrinsically, and forever a question of value and therefore a question for philosophy rather than for science.

It is just because, in the sphere of morals, problems of instrumental value (which may be attacked by the methods of science) are intimately connected with problems of intrinsic value (which cannot be attacked or solved by science and belong wholly to philosophy) that, in this sphere, science and philosophy are intimately blended, and that ethics and politics, although they involve properly philosophical problems, are often called sciences.

¶ 6. VALUES—SCIENCES VS. PHILOSOPHY. The claim of the aggressive scientists to be able to oust philosophy from these realms of value and annex them to science derives a certain plausibility from the fact that, in the fields of ethics and politics, all goods (*every* form of value, even those goods whose value is most indisputably intrinsic) can be plausibly regarded as contributing to the realisation of other goods; and this remains true even when some one highest good or value is recognised. If, for example, happiness is regarded as the one supreme good, it can yet be said that happiness favours social order, grace, kindliness, and many other good things; and these are propositions of fact, not assertions of value, and can be submitted to the pragmatic test of experiment. Nevertheless, this claim to replace moral philosophy wholly by science cannot

be made good; for, even under a system such as Bentham's utilitarianism (which recognises only one intrinsic good, namely, pleasure, and makes all other values merely contributory to this), the belief that pleasure is good or of value remains the product of an intuitive judgement and can never be tested or verified by any method known to science.

The demand made by some scientists that philosophy shall yield up all its territory to science, the claim that science can solve all the problems of philosophy is, then, an illegitimate one, and is properly resented and repudiated by philosophers. The realm of values belongs indisputably to the philosophers; it is and must forever remain their proper and their sole field. Although they need to bring to bear all the relevant knowledge that the sciences, and especially the science of psychology, can place at their disposal, they must continue to apply and develop their own methods to a multitude of problems of great difficulty and of the utmost practical importance.

If any aggressive scientist inclines to question this verdict, let him consider such problems as the nature and degree of obligation of the highly civilised peoples towards those of the simpler cultures, say, the red men and the 'coloured' people of North America, the pygmies of the Congo, or the native tribes of South Africa; or the problems raised by the extreme pacifist and by the 'conscientious objector' in time of war; by birth-control and eugenics; by communism, socialism, and fascism, and by chronic unemployment; the problems of the proper rôle and limitations

of patriotism, religion, education, political responsibility, police-power, punishment and criminal reform in the modern state.

¶ 7. VALUES AND THE PRAGMATIC PRINCIPLE. The illegitimate attempt to oust philosophy from its proper field by claiming to bring the realm of value-problems under the sway of the pragmatic principle is the chief ground of the common dislike of that principle. But it must be admitted that another ground of the opposition it encounters has been the injudicious use of language by some of its leading exponents.

Pragmatism is merely the conscious recognition of the method employed by all sound scientific enquiry and its extension to every kind of question of fact, including many questions which traditionally have been claimed as belonging not to science but to metaphysic, or to religion, or to theology, or to 'spiritualism', or to philosophy. But William James, who, more than any other, was the exponent of such recognition of the full scope of the scientific method, was fond of picturesque and striking and paradoxical language. He would say, or seem to say (or could, by a little ingenious twisting and biased selection of his words, be made to seem to say), that a proposition is made true by the verification of it (while, of course, a given proposition is equally true when it is a mere unverified conjecture or surmise and when it has received little or much verification; its degree of truth, of 'correspondence', is not altered by the process of verification or of refutation). Or he can

be made to seem to say that whatever proposition, even a deliberate lie, achieves a result we aim at (say the deception of our neighbours) is 'true', because it 'works'. And some of the other leading exponents of pragmatism, notably Dr F. C. S. Schiller, have been similarly indiscreet in their advocacy.

¶ 8. PRAGMATISM AND SCIENCE. The pragmatic principle, then, rules supreme in science. All scientific knowledge is embodied in propositions which are only relatively true and whose degree of truth (whose degree of correspondence with their objects) is and can only be shown by the pragmatic method, by putting them to the test, by making them guides to action, by treating them as working hypotheses. And, if we reform our terminology by differentiating the two meanings of the word 'true'; restricting the adjective 'true' to propositions of fact, and replacing it by the adjective 'valid' where propositions of value are concerned, we can broadly say: Only the scientific method, the pragmatic method, can establish knowledge or true belief.

There cannot be two or more different and incompatible true answers to any question of fact, one the answer of science, the other the answer of metaphysic or of theology or of any other discipline. Thus the question of the degree to which our description of spatial relations corresponds to some system of relations between things is a scientific question, to be answered only by the methods of science; there is no other method, call it metaphysical or philo-

sophical or what not, by which the question can be answered. Thus also the question of the existence and attributes of God or gods are scientific questions. Theology, in so far as it is a science, and seeks an answer to such questions, must use the method of science, the pragmatic method. Again, the question of human immortality, or the survival of human personality after death of the body, is a question to be answered, if at all, by the methods of science.

Hitherto we have discussed the pragmatic principle as rightly governing all attempts to render true descriptions of things and events. We have seen that verbal description inevitably involves interpretation; and the more so, the more general the terms of the description. But only when we turn to consider causation does the full scope and value of the pragmatic principle appear.

¶ 9. PRAGMATISM AND CAUSATION. In the Nineteenth Century, the hey-day of scientific naturalism, the exclusive sway of mechanical causation throughout the inorganic world was unhesitatingly and confidently assumed in the most literal sense by practically all scientists, and by many of the philosophers; not a few both of the scientists and the philosophers extended it to the realm of life and to man. This had the intolerable consequence that man had to be regarded as merely a machine, though a machine that, in some utterly unintelligible fashion, passively mirrored the physical world in his consciousness.

Various ways of stating the relation of consciousness to

the working of the machine were devised, epiphenomenalism, psycho-physical parallelism, the identity hypothesis, the double aspect hypothesis; all utterly unsatisfactory.[1] Since this 'scientific naturalism' or literal materialism has become intellectually disreputable, various ways of evading or side-stepping the causal problem have come into vogue, of which three are of chief importance.

There is the way of Vaihinger[2] (followed by many others) which, recognising the inevitability of the notion of mechanical causation in physical science and of teleological causation in what they call philosophy, asserts that both are pure fictions which correspond to nothing in reality. This, as we have seen, is the essence of what is called the neo-mechanistic doctrine.

There is the proposal of Karl Pearson to the effect that science may and should replace the search for causal explanation by the discovery of correlations, mere temporal conjunctions and sequences.

Thirdly, commonest of all, is the blank assertion that science should be content merely to describe and should forswear all attempt to explain or render intelligible the connexion of events. Of this last proposal, one variety deserves special mention by reason of the prestige of its chief sponsor.

Dr Lloyd Morgan tells us that physical science and mental

[1] As I have shown in detail in my *Body and Mind;* London and New York, 1911.

[2] The author of *Als Ob*, a book generally classed as an exposition of pragmatism.

science (or psychology) are 'closed systems', and that we must not seek, as scientists, any intelligible relation between these systems.[1] Further, he insists that neither system can legitimately admit causal interpretation, or recognise activity, agency, force, or anything of that kind; not, however, because the notions expressed in these words correspond to nothing in reality, but because such explanation or interpretation in terms of causation belongs wholly to metaphysic and theology.

All these proposed methods for extruding the causal principle from science are *prima facie* merely ingenious subterfuges for the avoidance of a difficulty. The position is well described by a Catholic philosopher[2] in a recent essay: "Now it is claimed in many quarters that there is no need of it (the idea of cause) at all. That may well be because physical science has chosen an aspect of the real which can be treated without it; at any rate that is for the physicists to decide. But the persisting presence of the notion is due to the fact that cause does belong to the real order from which science has abstracted its subject matter.[3] Even the philosophers, however, have been frightened of saying this, because in the train of Descartes they have broken

[1] In many works, but most clearly and unambiguously in a recent essay, *Psychology and Beyond* in the volume *Science To-day*, London, 1934.

[2] *Science and Theology* by the Rev. C. D'Arcy in *Science To-day*; London, 1934.

[3] I suggest that Dr D'Arcy might better have written in place of the words 'is due to the fact' the words 'is good evidence in support of the view'.

the chain which united together in some sort the world of sense and the world of intellect, the realm of quantity, quality, life and spirit. Hence they took their own experience of causality as subjective, as peculiar and doubtful, and considered that it would be anthropomorphic and illegitimate to transfer it to the physical world. And so arose the habit of speaking of logical connection as if it had nothing to do with connections in reality, and of laws of thought which ruled no kingdom of the world. Such a philosophy, thank heaven, is no better than a nightmare, and the truth is that our thought from the beginning takes its complexion from reality, and that just as it is impossible to think without using the category of ground and consequent, so it is impossible to think of reality without the principle of causality".

¶ 10. CAUSATION AND PHYSICAL SCIENCE. All the history of science shows that our Jesuit philosopher, rendered immune to the passing fashions of thought which sway the scientific world,[1] is on the right side in this matter. Everywhere in physical science we find the causal principle freely assumed and effectively used.[2]

[1] And sway also, one might add, most of the protestant philosophers who run tamely at the chariot wheels of science.

[2] For an example I refer to a recent article by one of the most distinguished of living physicists, Dr Max Planck. (*Causality in Nature* in the volume *Science To-day*.) Like most physicists he makes the assumption of causal relations in Nature, without stopping to justify it, and proceeds at once to the question of the validity of 'strict causality', by which he means strict universal determinism.

The theory of energy, including that of electricity in all its intimate ramifications, is wholly a product of the attempt to explain in terms of causation. The same is true of the biological sciences; in so far as they have advanced to the plane of understanding and interpretation which enables them to be practically useful as guides to action, such advance is essentially due to their use of the causal principle. Consider a few specific instances. Consider how great a rôle etiology, the search for causes, has played in medicine;

Incidentally, he remarks: "In classical theory, attention was concentrated on the elaboration of the causal view, that is how it has achieved its great successes". He writes of the problem of causality as "a problem quite pre-eminent in its fertilising influence on research". And of the law of causality he says: "It is rather a heuristic principle, a sign-post, and to my mind the most valuable sign-post we possess, to guide us in the motley confusion of events and to show us the direction in which scientific research must advance in order to attain fruitful results. As the law of causality immediately seizes the awakening soul of the child and causes (*sic*) him indefatigably to ask 'Why?' so it accompanies the investigator through his whole life and incessantly sets him new problems". Another leading physicist, Dr Hans Reichenbach, writes (in *Atom and Cosmos*) of causality: "The whole development of natural science in the following century is a single triumph of this great idea. Newton's mechanics, tested in the exact measurements of astronomy, the discovery of new forces of nature in electricity, or in unsuspected chemical energy, all furnished evidence for the fundamental idea of cause. The construction of machines of unexampled technical perfection, which was the practical result of such a science, was at the same time an ever-repeated confirmation of the underlying causal hypothesis, and no engineer would ever attempt to build or repair a machine, using any but a causal point of view."

how medical science has successfully sought for causal factors. The whole of the microbic theory of diseases, our modern understanding and partial control of small-pox, tuberculosis, syphilis, and all the infectious fevers, and almost all preventive medicine and public health measures have been developed through and depend upon the use of the causal principle.

The same is true of genetics and the great modern advances of the art of breeding animals and plants; although here our understanding remains very vague and incomplete. The theory of natural selection and all other theories of evolutionary process are products of the effort at causal interpretation, even though it be true that some description of the course of animal and plant evolution might possibly have been achieved without it.

In physiology the search for causal understanding has been essential as a condition of progress no less than in physics. Without it we might have achieved a description of the circulation of the blood, but should never have learnt to understand and, in some measure, to regulate its flow. All our knowledge of the *working* of the nervous system, all knowledge of ferments, enzymes, and hormones is of the same origin. In short all experimental science, and much that is based on simple observation, assumes and depends upon the causal principle.

It is the pragmatic principle itself, the very essence of the scientific method, which compels us to such causal explanations and justifies our acceptance of them as approximations to truth; and that in two ways. First, the

pragmatic principle is a principle of action; it directs us to experiment, to act, to influence the course of Nature, to intervene causally, in order to test our hypotheses, to discover whether our surmises, our propositions, about Nature 'correspond' to the facts of Nature. Thus, even while we are concerned only to *describe* natural things and events, the pragmatic principle requires us to assume the validity of the causal principle in order that we may test and establish the truth, the 'correspondence', of our descriptions.

Secondly, when we make the hypothesis of causal connexions between events, in order the better to understand and control them and direct their course for our own purposes, to gain the ends we desire to see realised, we find, in a multitude of instances, that our causal hypotheses work, that they are justified by the success which attends our actions when we accept them as guides to action. And thus our propositions of particular causal connexions are verified and justified in the only way in which any proposition (even the most purely descriptive) about Nature can be verified and justified; thus the causal principle in general is justified in the only possible manner and in the highest possible degree.[1]

[1] I am reluctant to criticise severely the life work of a distinguished colleague. But the high prestige enjoyed by Dr Lloyd Morgan among biologists, psychologists and philosophers compels me to be frank, and to say that I know of nothing more vicious intellectually than his attempt to isolate psychology from all its fellow sciences as a 'closed system', as an island without frontiers, and to hand over to philosophy all its most vital and interesting problems. It is the attempt of

¶ 11. MECHANISM AND CAUSATION. In view of the fact that so many writers treat the causal principle as identical with the mechanistic, implying or asserting that to repudiate mechanistic explanation in biology or psychology is to repudiate the causal principle, it is important that we make clear that such identification is quite without warrant.

Causal explanations were profitably sought long before the mechanical principles were defined; and at the present day we may and do make experimental investigation into causation quite independently of mechanistic theory. Consider an example which serves to illustrate the fact and at the same time the intimate relation between the pragmatic and the causal principles.

You observe on the grass of a meadow certain areas of

a man of philosophic tendency to escape from the intolerable implications of 'scientific naturalism', of a man who was brought up in the strictest school of Nineteenth Century materialism, an admiring disciple of T. H. Huxley. Still dominated by the prejudices of that school, which have in a measure sterilised all his psychological work, he forbids psychology to attempt to break out of the 'closed system' which he and others of his way of thinking have made it. What a mess the whole thing is! Physical science is one closed system, and psychological science is another. Yet both are systems of 'ideas'; and, as such, physical science falls within psychology whose province it is to deal with 'ideas'; therefore physical science has nothing to do with the real physical world. Yet the same man, as philosopher, has devoted several books to persuading us that all systems of ideas (including of course that system which is physical science) have 'emerged' out of inorganic or physical nature, a process which science is forbidden to attempt even to describe; for to do so would be to transgress the boundaries of the 'closed system' of psychology.

grass of a brighter colour than the rest; each of them is more or less of the form of a hollow circle. You form the hypothesis that they are due to fairies dancing in rings. It seems unsatisfactory, and you substitute rabbits or other animals, playfully dancing in rings. You notice that some of the circles are incomplete, and that others depart from the strictly circular shape; and your modified hypothesis does not work. You cannot form such rings by inducing animals to run round in rings. You then notice that some of the rings increase slowly in diameter. This leads you to surmise a process of growth. You take some of the grass from a ring, and transplant it to a fresh spot and observe the gradual formation of a new ring about that spot. You examine the grass of the ring microscopically and you find upon it a fungoid parasite. You repeat the observation upon grass from many rings, and in each case find a similar fungus; and you repeat successfully your experiment of infecting new areas. You have then formulated a good working hypothesis and have pragmatically verified it. Suppose that your discovery then becomes of financial benefit to yourself and of economic value to farmers in general; your hypothesis is validated not only theoretically but practically; you verified it for the sake of knowledge, the farmers verify it for the sake of economic advantage; but the processes are not essentially different, except in their motivation. Neither the theoretical nor the practical economic verification constitutes the truth of your hypothesis or makes it true; it only reveals the truth of it, its *correspondence* with fact. And the question of

mechanical causation has not been raised, still less answered. It may be that the fungus, like the fairies, prefers to disport itself in the circular form for good reasons of its own, or in virtue of some obscure 'circular' impulsion.

CHAPTER IV

THE RELATION OF PSYCHOLOGY TO OTHER SCIENCES

¶ 1. HIERARCHY OF SCIENCES? According to one view, the sciences must be regarded as forming a system of which mathematics and physics form the foundation, while the other sciences are built up on these foundations in successive layers or tiers of knowledge. The chemical sciences form the second tier; the biological a third; the human or psychological sciences a fourth. According to this view, solid advance at each level can be won only by successful interpretation of the phenomena dealt with in terms of the sciences of the more fundamental levels; in chemistry by the application of physics and mathematics; in biology by the application of chemistry, physics and mathematics; in psychology, by the application of the biology thus built up; in the social sciences, by the application of such psychology.

Some such scheme of relations is an inevitable implication of the strictly mechanistic view of the universe. And the implied scheme might be given a more definite form, namely, that of two pyramids; the one pyramid representing the 'natural sciences', with the more abstract sciences, mathematics, mechanics and the strictly physical sciences, forming its wide base; the chemical sciences with mineralogy, crystallography, astronomy, etc., forming a second stratum; botany, zoology, and the various branches

of biology, a third stratum; all these converging towards and supporting the apical area which is anthropology, understood as the science of man, the individual representative of his species, *homo sapiens*. The second pyramid stands on its apex poised upon the apex of the other. It represents all the human sciences; its lowest part is social psychology, the study of man as he actually occurs in all his complexity as a social being. Broadening out from this narrow base, the inverted pyramid includes, first, the more abstract social sciences, such as linguistics, mythology, comparative religion; then the more concrete, such as economics, jurisprudence, politics, all that the Germans call the *Geisteswissenschaften;* including, as the uppermost part of the upper pyramid, the sciences of history and sociology.

If we accepted the mechanistic theory of man, we should take literally this topographical scheme of the relations of the sciences, regarding each science as resting upon and derived from the sciences standing nearer to the base of the whole system, derived from them by applying, in its own sphere of more concrete objects and events, the principles of explanation achieved by the studies of abstractly simplified objects and relations.

¶ 2. EMERGENT EVOLUTION. If we modified the mechanistic theory by accepting the principle of emergent evolution as applicable throughout, we should still take the scheme literally, while recognising that the complex objects of the sciences standing higher in the scheme cannot be wholly

interpreted in terms of the principles achieved in the more abstract sciences, but require, *in addition to these*, certain principles peculiar to themselves which complicate, without abrogating, the sway of those more abstract principles. And this would be true whichever variety of the emergent doctrine we preferred, that of Dr Lloyd Morgan, of Dr S. Alexander, or of General Smuts.

¶ 3. TELEOLOGICAL ACTIVITY NOT 'EMERGENT'. If, however, we find good reasons for denying that the teleological modes of action, so clearly exemplified in all human activities, as well as by the higher forms of animal life,[1] can legitimately be regarded as having 'emerged' out of mechanism, we shall have to modify this topographical scheme more radically. Instead of the double tridimensional pyramid, we may take a similar two dimensional area. And here, reverting to our geographical analogy, we may usefully liken the whole system of sciences to the double continent of America. Let South America stand for the 'natural sciences' as commonly so called; North America for the *Geisteswissenschaften* or sciences of mind and its products, the human and social sciences. Then, according to most of the exponents of the *Geisteswissenschaften*, the two continents are wholly separated and relations between them are slight and of little importance; the one being wholly under the sway of mechanical principles, the other everywhere exemplifying teleological activities.

[1] Such reasons are set forth in my *Modern Materialism and Emergent Evolution*, London and New York, 1928.

¶ 4. 'SCIENCE' INDIVISIBLE. Such complete separation of the two great groups of the Sciences cannot be justified. It is to be achieved only at the cost of recognising two psychologies, two sciences of human nature, that are utterly different, so different that they have nothing to say to one another, no statement of fact, no hypothesis or theory in common; the one belonging to the mechanical group, that of the natural sciences, the other to that of the sciences of mind.

There are other objections to the complete separation of these two great groups of sciences; but the duplication of the science of man which it requires is the most serious. If the proposal were to put in the one group a science of man as a physical organism, and in the other a science of man as a mental or spiritual being, that might be a tolerable arrangement to those who can accept a clear-cut Cartesian dualism of matter and mind. But such dualism is not acceptable. If mind and matter are utterly different and distinct, they must be admitted to play upon one another most intimately all along the line; in all organisms and in all organic functions, rather than in some one very small part of the human organism alone, the pineal gland or any other part. Man cannot be understood by approaching him from either side alone, from the physical or the mental. He is in all his activities a psycho-physical organism; a comprehensive science of man must, therefore, make use of the double approach.

¶ 5. PSYCHOANALYSIS AND TEMPERAMENT. We see this

principle—the necessity for the double approach to man, the approach from the side of the biological sciences as well as from the purely mental side—vividly illustrated by the limitations and defects of the various theories of man set forth by the psycho-analytic schools. Consider in this connexion that aspect of personality which is properly called 'temperament'. The psycho-analysts, ignoring as they do the physiological approach to man, are able to recognise varieties and peculiarities of temperament. But physiological chemistry, with its discovery of the internal secretions, known as hormones or endocrines, is throwing a flood of new light on the facts of temperament; and any grouping of the sciences which ignores or forbids the full utilisation of this knowledge by the mental sciences is attempting to make them run blindfold. It is as though a man should attempt to traverse difficult unknown country with his eyes fixed upon the stars, refusing to glance at the ground on which, from moment to moment, he must tread, and scorning to use the maps which other explorers of less exalted vision have made.

¶ 6. RELATION OF PHYSICAL AND MENTAL. No, this division of the sciences into two unrelated groups, involving two distinct and utterly unlike sciences of man, is but another subterfuge, another way of avoiding the fundamental difficulty, the difficulty of rightly stating the relations between the physical and the mental. This relation is the toughest of all problems that challenge the intellect of man. It has been discussed more persistently than any

other, and still the solution eludes us. It may be said with confidence that we cannot profitably ignore the relation; and that to accept as anything more than a tentative working hypothesis any one of the various proposed solutions is vicious policy.

If we could in any way achieve a solution which we all could and must accept, that solution would decisively shape the system of the sciences. Lacking such a solution, we must accept the appearances at their face-value and must recognise the science of man as occupying a peculiar position between the two great groups of sciences, the sciences of Nature and the sciences of mind. In terms of our geographical analogy, we must recognise that the two continents, like the continents of South and North America, are not separated, but rather are joined together by a region which is common to both, a region relatively unexplored and unknown by reason of its extremely difficult nature. That region is the one which psychology is attempting to subdue. Through it must pass the main lines of communication between the two subcontinents. It remains a region covered with dense jungles and precipitous mountains. Some slight communication and profitable intercourse across this region have long been practised; but there are still no well established routes, no paved and graded through-roads, no bridges across the rivers and swamps. Even of the most general features of this region we have no maps that are established in general esteem by reason of their proved utility as guides to travellers.

¶ 7. SPATIAL ANALOGIES. This topographical scheme of the grouping of the sciences must not be taken to imply more than appears on the face of it. Unlike the double pyramid scheme suggested on an earlier page, it does not imply that the sciences of the one group are more fundamental than those of the other; it does not imply a hierarchical system. It does not imply the exclusive sway of mechanism in the one group, of purposive activity in the other. It does not imply that the sciences of the one group, or any one or more of them, are necessarily developed before others. It is a matter of history that in the modern period the physical sciences have advanced much more rapidly than the rest, the biological and human sciences. But this was due to the easier nature of those sciences and to a series of what may be called historical accidents, such as the opposition of the churches to the study of man.

¶ 8. UNIQUE POSITION OF PSYCHOLOGY. The main point illustrated by the geographical scheme is the unique position occupied by psychology at the junction of the two subcontinents, and its intimate relations of give and take with the sciences of both groups; on the one side with physiology, pathology, anatomy, and all the medical sciences, with zoology, genetics, theory of evolution and all the biological sciences, and (less intimately) with the physical or inorganic sciences and with mathematics; on the other side, equally intimate relations of give and take with all the sciences of mind, the social sciences, cultural

anthropology in all its branches, economics, politics, jurisprudence, penology (all those sciences which are so intimately concerned with the guidance of the lives of men in general that they are inevitably mingled with philosophy), and not least, with those most comprehensive and concrete sciences which attempt to interpret the life of mankind in all its aspects, physical, biological and cultural, namely, history and sociology.

It is this unique position of psychology with its reciprocal relations of give and take to all the other sciences that makes *the frontiers of psychology* a topic of so great and general interest. It is these relations we have now to consider a little more nearly; not attempting any exhaustive survey, but merely touching in an illustrative manner on some leading problems of prime importance.

CHAPTER V

THE FRONTIER TOWARD THE ABSTRACT AND PHYSICAL SCIENCES

¶ 1. FRONTIER TOWARDS MATHEMATICS. One of the least explored of the frontier regions of psychology is that which lies between it and mathematics. It may be looked at from either side. It looms as a vast jungle into which man has hardly begun to penetrate, yet it undoubtedly contains secrets the solution of which would bring great gain to both sciences. I am utterly incompetent to attempt any, even the most cursory, survey of it. I can only point to one or two fascinating problems of which I catch the merest glimpses.

¶ 2. ARITHMETICAL PRODIGIES. Consider the problem presented by the rare instances of arithmetical prodigies; the young boys who at an early age have shown astounding powers of calculation. In a few cases it has been shown that the prodigy possesses an unusually vivid and faithful visual memory. But this, in itself mysterious and intriguing, goes but a little way to explain the calculating powers of the more extreme instances. For some of these prodigies have been able to return correct answers, almost instantaneously, to problems for the solution of which an ordinarily good arithmetician, working with the aid of pencil and paper, requires some considerable time. In some such cases the prodigy himself is able to give not the

slightest account of his procedure; he lisps in numbers for the numbers come; and that, at present, is all we can say, except that the numbers that 'come' are astonishingly correctly related to the problems proposed. And the whole matter is rendered the more baffling by the fact that in some cases this 'hypertrophied special faculty', if we may so call it, disappears after a few years as mysteriously as it came, leaving its quondam 'possessor' just a very ordinary person.

¶ 3. GEOMETRICAL PRODIGIES. Here is another instance of a similar but still rarer and higher type.[1] An elderly lady "is one of the great pioneers of four-dimensional geometry". She "has had no mathematical training in the ordinary sense". She has led a normal life as wife, mother and mistress of a household, varied only by a yearly holiday of some weeks during which she has sought the company of mathematicians and has displayed a most unusual, perhaps a unique, power of thinking out in some geometrical fashion problems of multidimensional geometry which other mathematicians can deal with only by algebraical methods, and then only with difficulty. "Just as an ordinary non-mathematician can look at (say) a cube and tell you about its corners and edges and faces so she can 'look' at an imagined four-dimensional figure and declare the analogous information about it, even in some

[1] The facts of this case are unpublished. I have them on the authority of Mr H. S. M. Coxeter, himself an expert in multidimensional geometry. I cite them by his kind permission.

cases so complicated that the ordinary mathematician has to cover a sheet of paper with x's and y's in order to check her results". And though the polytypes or multidimensional figures which she seems to visualise are too complicated to be represented in drawings in two dimensions, she is able to draw any required cross-section of such a figure.

This strange power does not seem to be the product of any long course of cultivation. Its possessor seems unable to give any intelligible detailed account of her mode of working. And the case presents this further feature of extreme interest; the lady is the daughter of a mathematician famous for his contributions to the most abstract branch of mathematical logic, and of a lady of high intellectual powers, authoress of philosophical works of acknowledged merit. It would seem, then, that the faculty displayed is in some sense hereditary. What a problem for the psychological geneticist! What sort of a gene shall we postulate as the connecting link between the genius of the father and that of the daughter? What sort of special brain structure could such a gene give rise to? And what special brain structure could account for a so extraordinary 'faculty'?

¶ 4. SECRETS OF THE FRONTIER. I abstain from any further remarks on this frontier full of fascinating secrets. I have said enough to suggest that the secrets are there and well worthy of intensive study. I will only refer to a recent article by a distinguished mathematician[1] and draw

[1] Birkhoff; *Quantity and Order* in the volume *Science To-day*.

attention to its strikingly psychological flavour, as when he says: "the chief function of mathematical symbolism is to enable the human mind to carry through certain processes of logical thought", and that "mathematics is the codified body of *all* logical thought"; or: "The world in which we live is permeated with structure . . . It is even possible that the structures outside and inside are intimately related, at least it is only by means of our mental processes that we succeed in controlling the external world".

¶ 5. FRONTIER TOWARD PHYSICS. I am hardly less incompetent to say anything about the frontier-region between psychology and physics. But again I venture a few remarks that may serve as pointers to stimulate enquiry. In the Introductory Chapter I have already indicated that the physicists themselves are making excursions into this frontier region. In the main the physicists of the past have performed their feats of abstraction without any clear consciousness of what they were doing. But of late years there has been a great change in this respect. One physicist after another shows an increasing sophistication; becomes aware that all his description of the physical world is a system of symbols, a construction of the human mind, which cannot possibly be regarded as a literally true and accurate picture of the physical things and events described, and that the same is true of the laws which he 'discovers' as 'regulating' its events, or 'operating upon' its 'entities'. Baffled and a little dismayed, he inclines to become a

sceptic, a pyrrhonist, a sensationist, a fictionist, a pure idealist, or a solipsist. Perhaps a little more psychology is the needed corrective which will lead him to a self-conscious and rational pragmatism.

The physicist is learning also that truth which psychologists themselves have been slow to appreciate; namely, that the scientist is not a passive observer, that he is essentially an active being, whose observing is an active intervention in the course of natural events, an intervention governed by selective purpose; that all his most purely intellectual operations upon his data (already selected, filtered and influenced by his intervention) are similarly selected and governed by his particular special purposes.

¶ 6. THE HUMAN MIND IN ASTRONOMY. It might be thought that the astronomer, if no other physicist, would remain immune to such psychological sophistication; continuing to regard his world as utterly objective, his description of it as un-infected by the peculiarities of the human mind, by its weaknesses and limitations. For it was the great success of the strictly mechanical descriptions and causal explanations of astronomy that gave to the mechanistic doctrine its immense prestige and made it the accepted model for all the other sciences. Yet the modern astronomer shows no such immunity.

Curiously enough, it was a problem of this most objective of the sciences that first revealed a common ground between psychology and physical measurement. The astronomer's

problem of the observer's reaction-time became the starting point of a host of psychological experiments.

But the modern astronomer is far more deeply conscious of his affinities with psychology. One of the most distinguished of them writes in a recent article as though he regarded astronomical research as chiefly of value for the light it throws on psychological problems. Dr Herbert Dingle[1] writes: "When we come to the universe we are in a realm of pure theory. . . . The universe of astronomy is a creation of the astronomer's mind". Modern astronomical theory is "intricately entangled with the psychology of the astronomer . . . scientific theory is indeed a work of art, supplementing the truth of discovered fact by the beauty of conscious creation". Again: "It is best not to try to visualise finite space. By exercising a strict abstemiousness of imagination we have hitherto accepted infinite space without question, although that too is beyond mental vision. It is scarcely logical to scorn finite space for a quality which its rival equally possesses, and it is not easy to see why there should be a universal instinctive tendency to do so". He expresses, at moments, a thoroughly pragmatic attitude. The astronomer, he tells us, "displaces contemplation by action; he no longer says, 'Look at this', but 'Do this' and the new injunction removes the possibility of self-deception which was only too easily realised under the old".

Perhaps our author goes too far in this direction.

[1] Dingle; *Astronomy and Scientific Ideas* in *Science To-day*, London, 1934.

"Scientific investigation appears to have undergone a change of character, though what has actually happened is that our understanding of its character has undergone a change. The older astronomer was inquiring, or thought he was inquiring, immediately into the secrets of creation . . . we do not now study direct creation so much as the idols of our own conceiving. . . . The subject-matter of our investigation is not the work of God's fingers but the work of man's imagination. . . . The model of the universe which astronomy has been building up since the time of Galileo is an ideal one, constructed of bricks made from rational conceptions, not from sensible experiences. The open acknowledgment of the fact, made during the last decade or so, is the result not of a revolution in method but of a clearer understanding of what has been done in the past and a greater freedom in employing conceptions which have no obvious analogues in experience. The exercise of this freedom is the source of much of the difficulty met with in trying to understand recent developments. . . . What we thought were direct revelations of nature we find to be our own inventions . . . not arbitrary inventions, it is true, for we choose them in order to give coherence to facts given us in observation, but nevertheless, inventions which further experience may force us to modify perhaps beyond recognition. We thought them facts which were eternal, and we find them ideas which are transient, or at least protean".

Astronomers, we are told,

"realise that whatever grandeur belongs to the universe they picture is a grandeur of their own creating, and they hesitate to proclaim it. . . . If modern astronomy reveals to us more of the nature of our minds than of the external world, is the exchange so much to be deplored? For it is

not the arbitrary, capricious, personal elements of our minds that are embodied in astronomy; they can be left to psycho-analysis to do with them what it can. Astronomy absorbs the universal impersonal factors which form the substratum of mental life. The universe we contemplate today may disappear tomorrow, but it represents a mental *nexus* between the diverse facts of present experience which is not the whim of a single astronomer, but one of a few alternatives forced on all by the nature of logical thought". And the final up-shot is "the knowledge, felt rather than thought", that "the universe is no chaos but that all its diverse elements are bound together into an ordered whole by the stuff of which man's mind is made".

Here is 'subjectification' with a vengeance. Clearly Dr Dingle is in danger of falling into that scepticism of which Needham is the avowed exponent, a scepticism which would make of astronomy, as Needham makes of biology, a system of fictions wholly determined by the peculiarities of man's mental power or 'twists'; a scepticism tending to become radical because, for the scientist, beginning to psychologise about his labours, and not having fully grasped the pragmatic principle, the meaning of the word 'truth' is apt to become nebulous and uncertain and the earlier struggles for truth nothing more than 'old forgotten far-off things and battles long ago'.

But if we cannot agree that the most significant achievement of modern astronomy is its contribution to psychology, 'the realisation which it brings of the nature of astronomical conceptions', if we cannot agree with this astronomer in his proposal to make of his science a branch

of applied psychology, we may at least be grateful for his advance into the frontier region between astronomy and psychology, his indications that much remains to be learnt in that region with advantage to both of the sciences concerned.

¶ 7. THE HUMAN MIND IN PHYSICS. The author of the article on *The Trend of Physics* in the same volume, Dr A. S. Eve, is hardly less psychologically inclined, though less in danger of lapsing into pure 'fictionism'. He begins by psychologising freely:—

"As a necessary result of his upbringing in the realm of Nature, man has habits and ideas derived from his inherited characteristics, his environment, memory and the speeches and writings of his fellow-men. Illuminated by occasional flashes of genius he can produce something the existence of which was previously unknown. For the most part the Universe is a mirror wherein each man sees his own image, a reflection of his own universal experiences. His own image is stamped on all that he would pass as true coinage".

Further:

"It is not easy to summarise present ideas of the fundamental notions and conceptions of science. There appear to be, on the one hand, observation, experiment, experience, perception, all imperfect; on the other hand thought, imagination, abstraction, reasoning, conception. From these imperfect parents arise a new offspring, a proposition, a conclusion, a principle, a theory, something which is sometimes very improperly called a Law of Nature, for the idea is in the mind of man".

Here, then, is the same recognition of the frontier region

and of the need of physics for the aid of psychology; for it is certain the author cannot regard his naïve and primitive psychologising as the last word on that subject.

¶ 8. PSYCHOLOGY OF PHYSICISTS. The passages cited may serve as fair samples of the psychological disquisitions that are abundantly scattered through the writings of physicists. Even the sober and orthodox and old-fashioned text-books of physics contain them. The more modern the writing, the more do they abound; and the more numerous they are, the more 'philosophical' is the discussion, in accordance with that usage of the term 'philosophical' defined on p. 6. In a recent much and justly lauded work of this kind I find recognised (over and above the functions of the five senses, and those of sensation, perception, conception, meaning, judgement, concepts, ideas, induction, deduction, which physicists in general postulate with but little recognition of the difficulties involved in any attempt to use such words accurately) the following psychological functions or faculties invoked at critical points of the discussion: *innate sense of values*, *inner sense of values*, *innate sense of fitness of things*, *inward sense of fitness*, *intuition*, *intuitive sanctions*, *inner convictions*, *forcefulness of feeling of awareness*, *scientific instincts*, *feeling of purpose which urges*, *a desire for truth which is in our own nature*, and many more.

Other physicists are as ready as Dr Dingle to claim that the chief triumphs of the physical sciences are in the field of psychology. "The outstanding achievement of twentieth

century physics", says Sir J. Jeans, "is the recognition that we are not yet in contact with ultimate reality", but "the universe can best be pictured although still very imperfectly and inadequately, as consisting of pure thought". Again: "Nature and our conscious mathematical minds work according to the same laws. She does not model her behaviour, so to speak, on that forced on us by our whims and passions . . . but on that of our thinking minds. . . . The Universe cannot admit of material representation, and the reason, I think, is that it has become a mere mental concept".[1]

In similar vein Sir A. Eddington writes: "The frank realisation that physical science is concerned with a world of shadows is one of the most significant of recent advances. . . . It is difficult to school ourselves to treat the physical world as purely symbolic. We are always relapsing and mixing with the symbols incongruous conceptions taken from the world of consciousness. Untaught by long experience we stretch a hand to grasp a shadow, instead of accepting its shadowy nature".[2] Such somewhat naïve confessions of the physicists' need for some psychology less inadequate than that embedded in common speech are abundantly illustrated by other passages in the works of this author.

Dr Hans Reichenbach goes further and is as frank as Dr Dingle in claiming for physical science its chief triumphs in the field of psychology:

"In addition to all its discoveries as to the essential

[1] *The Mysterious Universe;* London, 1932.

[2] *The Nature of the Physical World;* London, 1928.

characteristics of physical nature, modern natural science has, then, the other great achievement to its credit of showing the way to a generalisation of customary forms of human thought, and of leading the human spirit out of the narrowness of traditional habits of thinking, to freer use of its own intellectual powers. . . . Herein lies its great influence on the education and formation of thought. . . . It may, perhaps, be regarded as the greatest of all the results of modern natural science that the world picture to which it has led, at the same time brought to light a new picture of man as a thinking spirit; for natural science has taught us that reason is not a rigid chest of logical drawers, that thought is not the eternal repetition of inherited norms, but that man grows by learning, and carries in himself the capacity for forms of thought which, at an earlier stage, he was unable to imagine. Only one who has understood something of this effect of physical thought on the structure of the contemplative spirit may say that he has become acquainted with the physics of today. And our presentation of modern physics could, therefore, have no higher aim than to tell of this effect of scientific research on the thinking of men".[1]

This author has much to say of the way modern physics has achieved a revolution in ways of thinking:

"The historian will be able to recognise that this revolutionary trait can just as well be described as a return to the methods of Galileo, who likewise neglected the unity of the physical picture of the world as not yet attainable, and concerned himself with the rigorous, thorough study of single fields; only that ageing physics which, in the times of our fathers, had grown together to a rounded-out

[1] *Atom and Cosmos,* New York, 1933.

system, had allowed this sound method of thought to be forgotten, and had therefore to submit to a new revolution, when, confronted with the facts of atomic occurrences, the traditional science proved wanting

"It is, certainly, more instinct than logic, more naïve confidence in the success of human activity than systematically planned development of scientific work, which stands behind such a positivistic manner of thought. That is not meant as a disparagement; on the contrary, it is just the method which has led to the success of modern investigation of Nature. . . . Between the physicists' manner of working and the method of physics there is, therefore, a great difference; the physicist works intuitively, full of phantasy, with instinctive premonition of the correct relations, whereas the physical method is strictly critical, unemotional, full of logical precision".

¶ 9. PHYSICS AND PSYCHOLOGY—RECIPROCAL CONTRIBUTIONS. As a psychologist I gratefully accept all these contributions from physics to psychology and wholly approve these excursions into frontier territory. I am concerned however to suggest that the good offices should be reciprocal; that, while physics has much to say of psychology, psychology has something to contribute to physics; and that the physicists who are thus so freely pioneering in the frontier region might profit from some study of the psychological side, instead of relying as they commonly do upon the crude misleading psychology embedded in common language and literature.[1]

[1] To substantiate the last sweeping statement would require a host of citations. A single one from a highly esteemed physicist may

serve as illustration of the common procedure. Sir J. Jeans (*op. cit.*) writes: "Objective realities exist, because certain things affect your consciousness and mine in the same way, but we are assuming something we have no right to assume if we label them as either 'real' or 'ideal'. The true label is, I think, 'mathematical'. . . . The label we have selected does not of course relegate matter into the category of hallucinations or dreams. The material universe remains as substantial as ever it was, and this statement must, I think, remain true through all changes of scientific or philosophical thought. [Yet on another page he foresees the universe as 'totally devoid of substance'.] *For substantiality is a purely mental concept measuring the direct effect of objects on our sense of touch.* . . . Yet the fact that we possess no absolute extraneous standard against which to measure substantiality does not preclude our saying that two things have the same degree, or different degrees, of substantiality. . . . Creations of an individual mind may reasonably be called less substantial than creations of a universal mind. A similar distinction must be made between the space we see in a dream and the space of everyday life: the latter, which is the same for us all, is the space of the universal mind. It is the same with time, the time of waking life, which flows at the same rate for us all, being the time of the universal mind".

With this and much more of such 'fine confused feeding' does our most popular exponent of physical truth lead up to his much celebrated pronouncement about the Great Mathematician. What I am concerned to point out is the fact that the *pièces de résistance* of this farrago, the meaty chunks of this haggis, are scraps of popular psychology, all false or very disputable or so vague as to be highly ambiguous. Wrestle with the sentence I have italicised and what can you make of it? The most striking implication is that while some concepts are purely mental, others are non-mental.

CHAPTER VI

PROBLEMS OF THE FRONTIER: QUALITIES, SPACE AND TIME

Let us consider very briefly in this chapter some of the more important of the problems of the frontier between physics and psychology.

¶ 1. PRIMARY AND SECONDARY QUALITIES. The first to come into prominence was that of the primary and secondary qualities of physical things. The intimate concern of both the sciences, physics and psychology, in this problem is illustrated by the fact that the distinction between primary qualities (those of shape, size, solidity, mass, position and motion) and the secondary (colour, sound, odour, warmth and cold) was first clearly made by a physicist, Galileo, and shortly afterwards, apparently in entire independence, by the father of modern psychology, John Locke.

These two pioneers, approaching the problem of the interpretation of physical observations, the one from the side of physics, the other from the side of psychology, agreed in assigning the primary qualities to the physical world and to the physicist, the secondary to the mental world and to the psychologist. And, in spite of the modern school of philosophers known as Neo-realists, this distinction has been commonly accepted and preserved as one of importance. Yet much remains obscure and debat-

able. Putting aside the view of pure idealism (for which the physical is merely phenomenal, a mental construction and nothing more), adhering rather to the realist position that, in sense-perception, the observer commonly becomes aware of something which truly exists independently of him (and of every perceiver) and in some sense acts upon him by way of his sense-organs; we still are faced by various possibilities of interpretation, problems essentially of the frontier, of two fronts, that towards physical and that towards mental science.

¶ 2. ACCEPTANCE BY PHYSICISTS. The physicists have accepted the distinction and the assignment of the primary and secondary qualities to the physical and mental spheres respectively, firstly, because this has greatly facilitated the mechanical interpretations of all physical events; it has proved an excellent working hypothesis; that is to say, it has been pragmatically justified as a guide to physical experimentation; secondly, because it has relieved them of all obligation towards the secondary qualities.

¶ 3. SECONDARY QUALITIES AND THE PSYCHOLOGISTS. The psychologist has accepted the secondary qualities as wholly mental, and as mere signs of particular conjunctions of primary qualities in the physical object perceived. He finds good ground for this, first, in the fact that the physical messages which he receives from physical objects are commonly subject to various translations of mode before they excite in him the secondary qualities; light, for

example, seems to travel through space from the distant object as one mode of physical change or energy-transmission; this to provoke in the eye a chemical change; and this in turn to excite in the optic nerve a third type of energy-change which propagates itself to the brain, there to provoke in all probability a fourth mode of physico-chemical change.

Secondly, he is familiar with the fact that different physical stimulations of any sense-organ may excite similar sensory qualities; that, for example, the qualities of colour and of heat and cold can be excited by gross mechanical stimulation of the sense-organs as well as by light and by temperature changes respectively. Thirdly, he finds that the one sensory nerve, however variously stimulated, seems to mediate always and only the one secondary quality proper to itself. Yet how these secondary qualities are evoked, and how they are correlated in fairly constant fashion with various forms of physical stimulation, these are problems which remain unsolved in spite of various rival hypotheses and much debate; they are, in short, essentially frontier problems which seem likely to yield only to a combined assault from both sides.

¶ 4. PRIMARY QUALITIES: SHAPE. In face of the primary qualities the psychologist feels himself even more perplexed than by the secondary qualities. The problem has gradually become clearly defined only in the modern period. Locke, like all his predecessors, was content to assume that the shape of the physical object somehow impresses itself

directly on the mind; and some modern psychologists go beyond this only in assuming that the shape is projected upon the sense-organ and somehow transmitted to the brain. Yet, even if this be the case (and it is wildly improbable and against such evidence as we have) the problem remains: Why, given a triangular area of excitement in the visual brain-cortex, should the colour we perceive appear to us distributed over a triangular area of definite size and position and distance from us?

¶. 5. SPACE AS A FRONTIER PROBLEM. Kant raised for the first time a most disturbing question. The objective validity of our spatial perception had never been seriously questioned. But Kant said: The human mind is so constituted that, whether in perceiving or merely imagining, it does and can only think of physical objects as spread out in tridimensional space. Such spatial thinking, or representation, being then an inevitable mode of functioning of the mind, what guarantee have we that it corresponds literally with the properties of the physical object? How can we validly infer from the spatiality of our perception to a corresponding spatiality of the object? And his answer was that we have no guarantee, that we cannot safely make this inference. And this answer, since the time it was first given, has been fortified by a multitude of instances in which it is found that our various modes of spatial perception fail to confirm one another precisely; all the forms of illusion in space-perception, instances in which we ascertain what we call the true spatial properties

of the object only by complicated processes of correction of one perception by another, according to conventional rules.

¶ 6. PRAGMATIC SOLUTION OF DIFFICULTY. Yet, when we apply here the pragmatic principle, we do find abundant justification for believing that our spatial perceptions (thus corrected) are in some sense and degree true, that the spatial relations we think of as holding good of the objects do 'correspond' in some regular fashion to real relations of the real objects. For it is by accepting our spatial thinking as symbolising more or less adequately, and as corresponding to, real relations that we guide our actions upon and about physical objects with considerable success.

And then we strengthen this direct pragmatic argument by introducing the evolutionary point of view. In all but the most lowly animals we find sense-organs adapted to receive spatially extended impressions; we find the animals distinguishing and recognising objects according to their shapes and sizes; and we find that the higher the animal in the scale of intelligence, the more elaborated are these organs of spatial receptivity, and the more precisely are its movements guided in relation to the spatial properties that we perceive in the physical world, properties perceived or remembered by the animal as guides to action. We see, then, that there has been a gradual evolution of the power of spatial perceiving and imagining and remembering, culminating in the geometrical powers of the human species, and carried in that species to various levels of

efficiency, some humans (as in the case on p. 73) greatly surpassing others in this respect.

Thus we arrive at the insight most emphatically expounded by Prof. Bergson; namely, the pragmatic justification of our individual and human spatial thinking is re-enforced by the larger pragmatic justification, namely, the success of such spatial representation as occurs in the animal world. Such thinking has proved itself to have survival value; for it has been developed in many forms and through many different types of sense-organ; and everywhere its prime function has been the guidance of action in the struggle for existence. And in ourselves, the most intelligent animal species, the function is of high efficiency and must therefore 'correspond' effectively to some all-important system of relations in the physical world that we inhabit.

Not only so; the function is so highly evolved in us and so habitually invoked and used that we find it difficult to think of the physical world in any other terms than those of tridimensional space, and are naturally inclined to regard such thinking as having greater validity and truth than any other mode, and even as corresponding literally and exactly (when duly corrected) to a system of relations obtaining between our physical objects. Yet that such natural inclination is not well founded is obvious when we reflect how much in need of correction, how inferential and indirect and lacking in precision and trustworthiness, is the greater part of our spatial perception, how abstract, how remote from concrete perception, is the spatial thinking which we call geometrising.

¶ 7. PSYCHO-PHYSICAL BASIS OF SPACE PERCEPTION. We remain ignorant of the nature of that elaborate organisation which, as we can confidently infer, underlies and is presupposed by all developed spatial thinking. Psychologists are not even agreed as to whether this is given in the hereditary constitution in relatively complete form, or in germ, or is developed anew in each organism by the exercise of its sense-organs. All we can positively assert is that we cannot be content to assume as an essential faculty of all minds an innate power of spatial ordering and interpretation of sense-impressions, but that, rather, such power of spatial interpretation as any species possesses is the synthetic and complex product of a long evolutionary process of adaption to the environment; that, therefore, though we may infer some considerable degree of 'correspondence' between our spatial thinking and the nature of the environment, such 'correspondence' is but an approximation to truth or complete correspondence, and leaves open the possibility of other and perhaps more useful ways of spatial thinking.

Especially the psychology of space teaches us that Space as we commonly conceive it is not a concrete object but an abstract one, an object conceived through much abstraction from many experiences of concrete spatial relations of many kinds.

¶ 8. MATHEMATICAL SPACE. About the same time that psychology arrived at this sceptical and purely pragmatic estimate of our spatial thinking, mathematics 'the science

of the possible' woke up to the realisation of the same principles, and found that tridimensional spatial thinking was not the only form of it that could pragmatically justify itself; that for certain purposes four-dimensional thinking was useful. The mathematicians evolved a system of symbols to facilitate this and other forms of multi-dimensional thinking. Then came physics, 'the science of the actual'. Applying the same pragmatic scepticism, physicists found that certain problems became simplified, if the old assumption of the literal truth of Euclidean space was discarded in favour of other assumptions. They began to see that all axioms might with advantage be treated as postulates made for our own particular purposes and selected with particular ends in view, and that certain physical problems may be solved more satisfactorily in terms of postulates about the nature of spatial relations other than those of Euclid.

Thus physics and psychology have arrived at agreement in the view that Euclidean space is a highly artificial convention, a product of the social mind, something very different from the space actually experienced by the individual, save in so far as his thinking is disciplined in accordance with social conventions regarding space.

¶ 9. TIME AS A FRONTIER PROBLEM. Our thinking about time is no less clearly a problem of the frontier between physics and psychology. It is clear that our immediate experience of duration does not give us evenly flowing periods, uniform sections which could be described as

exact multiples of some unit. That way of conceiving time is the product of much correction, mainly through comparison of one man's experience with another's; it was not achieved with any precision until after Galileo had taught us, through his experiments with the pendulum, to construct exact chronometers or clocks.

The eye, our most highly evolved organ of spatial perception, enables us to receive an impression of extension from a momentary stimulation. Such instantaneous impressions of extension led men to conceive of space and spatial perception as independent of time, and to think of a spatially extended world which might be validly described in static terms and validly conceived as capable of enduring without change. Yet all more exact appreciation of spatial relations, and especially all measurement of spatial relations, involving as it does comparison of one spatial impression with another, requires time (is a process of some duration) just as does every other mental activity. And more exact psychological investigation has revealed that our perception of duration and of order in time is, like that of spatial relations, subject to various distortions and illusions. Further, it became clear that all perception of time-relations involves memory, a function absolutely peculiar, so far as can be seen, to living organisms, a function which somehow bridges the intervals between one impression and another, whether it be the interval between two ticks of the clock or the interval between youth and old age, and makes of past experience a causal factor in our present activity. And this same peculiar memory-function seems to pervade

not only our individual lives, but the life of the race, 'binding the generations each to each'.

It may be said, in short, that the bridging of the interval between past and future, the bringing of past experience into causal relations with present action and with that intelligent anticipation of the future course of events through which alone we can guide our actions so as to achieve our purposes, is the essential and most distinctive function of mind. Man, it has been said, is before all things, the time-binder, one who looks before and after, and longs and strives for what is not, for what, but for his striving, will never be.

¶ 10. TIME AND MEMORY. Recent psychological studies have deepened the mystery of time and memory. For they seem to have shown a power of foresight of the future which outruns all prediction based on memory of the past and is not due to calculation of probabilities based on the assumption of the uniformity of natural law; a foresight of a kind and degree which seems to show that our conventional view of time requires some radical reconstruction if it is to 'correspond' with objective fact.[1]

Time and memory are, then, but two aspects of one mystery. And it is a problem of the frontier. For the

[1] I refer here more especially to the observations on prophetic dreaming reported by Mr G. W. Dunne in his *An Experiment with Time* (first ed., London, 1927) and to experiments by Dr J. B. Rhine (reported in the volume *Extra-Sensory Perception;* Boston, 1934), in the course of which occurred series of correct anticipatory guesses (not yet published in detail).

physicists also are concerned with this problem. They, having succeeded in measuring the flow of time with great precision, in establishing upon such measurements predictions of astonishing accuracy, and thus pragmatically justifying the conventional thinking of time as a uniformly flowing empty 'I know not what', have become dissatisfied with this way of thinking. They have realised that the physical world (in all its parts) is not static, but rather a world of perpetual change in which every part is in reciprocal dynamic relations with the whole; that, since change involves duration, no static description of any physical phenomena can be literally true; that we approximate more nearly to true description when we introduce time relations as well as spatial relations; and that all causal explanation essentially requires that the temporal aspect be taken into account. Mass, for example, essentially involves time. In a timeless world the word would have no meaning. Thus the physicists are led to regard time, not as an independent variable, but rather as a dimension of physical events, a dimension without which any description of physical phenomena is as inadequate as one rendered in terms of two dimensions of space.

¶ 11. SPACE AND TIME: ABSTRACTIONS. Space and time, then, are alike in that we do not perceive them through special senses; we have no sense-organ which is stimulated by space or by time. They are not forms of energy that could play upon our senses. They are forms of relation which we have learnt to conceive in conventional fashion

through long and complex processes of elaboration by the social mind. Psychology and physics converge to the view that the conventional way of thinking of space and time is not necessarily final, is not fixed forever either by some fundamental changeless constitutional peculiarity of all mind, or by a degree of 'correspondence' with reality achieved by the mind of the species *homo sapiens* in the course of its evolution, and now incapable of improvement.

Space and Time are alike abstractions from our concrete experiences. Yet, when the physicists and some philosophers propose to substitute for Space and Time conceived as independent realities (the one of three, the other of one, dimension) a four-dimensional reality which they would call Space-Time, the psychologist finds two objections. First, Space-Time is still an abstraction from our experiences of concrete events. Secondly, time and space cannot properly be given an equal status in the scale of relative truth or degree of correspondence. In that scale time must be accorded a rank superior to that of space. For much of our experience is non-spatial, as when we perceive or imagine music, or when we reason about moral problems; whereas all our experience, both perceptual and purely imaginative, is temporal, involves experience of duration and succession. Hence, though we can conceive a non-spatial world of real beings and events, we cannot conceive a world of reality without duration.

It is clear, then, that space and time remain problematical; they are problems of the frontier; for they require the double approach, from the physical and from the mental side.

CHAPTER VII

PROBLEMS OF THE FRONTIER: ENERGY AND FORCE

That Energy and Force are problems of the frontier between physics and psychology is acknowledged by many physicists in the form of some slight disquisition on the 'muscular sense' written as an approach to these problems.

¶ 1. FORCE VERSUS ENERGY. Words of meaning kindred to both 'energy' and 'force' have long been current in many languages. But it was not until the middle of the Nineteenth Century that the two words became clearly differentiated. Force and forces were then relegated to a peculiarly ambiguous and uncertain position or status. Energy, on the other hand, was elevated to one of the first rank. For a time at least energy was placed among the fundamental physical realities or necessary postulates of physical science, together with matter, space and time; a list to which many physicists added electricity, and ether (the nominative of the verb to undulate, as it has been well called).

¶ 2. MATTER AND ENERGY. In the Nineteenth Century many physicists attempted to describe all energy as the momentum of masses. But the facts of gravitation, of electrical attraction and repulsion, and the inevitably postulated latent or potential energy, especially latent

chemical energy, remained recalcitrant to the attempt. Some physicists inclined to regard energy as an entity or form of real being distinct from matter. Then at the end of the Nineteenth Century came the proposal to abolish matter and to regard the whole universe as a system of energies of different kinds, including mental energies (Ostwald). But matter continued to manifest its atomic or corpuscular constitution with increasing insistence; while at the same time the forces of chemical attraction and repulsion became more clearly electrical, and all radiant phenomena became waves in the ether differing from one another in respect of an immense range of wave-lengths and frequencies.

Then came the demonstration of the corpuscular nature of electricity itself; followed by the resolution of the atom of matter into some swarm of such electric particles; and more recently the quantum theory of energy which makes radiant energy itself corpuscular, and light no longer a wave in the ether, but a stream of minute packets of energy, the photons, packets of energy which resemble matter in that they gravitate or have weight and mass. Further, it appeared that all energy has mass.

Then the conflict between the corpuscular and the wave theory of light, followed by the decision that both must be accepted; that light is a stream of corpuscles, but each corpuscle a packet of waves or undulations, a 'wavicle'.

With these changes came the demonstration that matter and energy must be regarded as convertible the one into the other; in fact, a breakdown of the distinction between

matter and energy. "The tendency of modern physics is to resolve the whole material universe into waves, and nothing but waves" and thus to "reduce the whole universe to a world of radiation, potential or existent".[1]

Thus physics finds itself committed to frankly unintelligible assumptions; as, for example, the wave demands a medium through which it may propagate itself continuously; but the modern wave of the photon is a wave without a medium, the verb to undulate without a nominative. The difficulties involved in the new atomism suggest that the problem of energy requires to be approached anew from the psychological side as well as from the physical.

How, then, have we arrived at conceiving force and energy, these most elusive yet indispensable constituents or aspects of the physical world?

¶ 3. MENTAL ENERGY. Many physicists are apt to resent the use of the term 'energy' in psychology; asserting that the conception of energy is essentially quantitative, arrived at by measurement; and that the word should therefore not be used where no exact measurement of work done is possible. But this jealous proprietary claim is like that of the rich landlord over the common land which he has enclosed and filched from the common people by denying their rights in it. For there can be no doubt that the conception, the way of thinking, represented by the word 'energy' was of slow and ancient growth. If we may infer from the thinking of our 'contemporary ancestors' to that

[1] Sir J. Jeans; *The Mysterious Universe;* London, 1932.

of primitive man, it would seem that energy was in some sense recognised, thought of and spoken of, long ages before science and philosophy began to take shape.

¶ 4. POWERFULNESS. Perhaps the word 'power' is a nicer translation of the words used by men of simple culture in thinking and speaking of that which is active in producing change; the word represents the undifferentiated mode of thinking that obtained before force and energy were distinguished from one another. Power was primarily *powerfulness*, the attribute of strong or powerful men, wizards, priests, chiefs and great warriors. The deeply rooted tendency to abstract any quality in which we are keenly interested and, having named it, to think of it as a thing, an independent existent, seems to be common to all men, from the most primitive to the most sophisticated. The strong or powerful man was thus endowed with power; and his power was regarded as something separable from him, something that might be taken away from or added to him, partially or wholly, as Samson's power was shorn away with his locks. Power was also something that might be communicated in various quantities or degrees from one creature to another; as when a man acquires power by eating a bit of the flesh of a tiger or of a great warrior, or by any one of many rites which induce what the modern anthropologist calls 'mystic participation'. *Mana*, *orenda*, and many other words of primitive languages are names given to such power.

We may go further back and assert that the *powerfulness*

or power thus attributed to powerful beings was an object of thought which each man arrived at only by aid of abstraction from his own experiences of exerting power. Each man had experience of striving, of commanding his dog or his fellows, of pushing, pulling, wrestling, of propelling a boat, a stone, a spear, of setting things in motion, in short of exerting himself, of putting out or expending effort, power, virtue, thereby producing changes. Further, he had the experience of finding himself, in consequence of great effort, depleted of power or wellnigh powerless; a condition which contrasted strongly with the condition of greatest power, one directly felt and realised in action after plentiful food and rest.

¶ 5. FORMS OF 'POWER'. In some such way did primitive man come to think of power as something distinct and separable from the powerful being; yet physical, moral and magical power were not clearly distinguished from each other. Only gradually were distinctions made between 'powers' of different orders; and even today in common speech we use in the main the same nouns, such as power, strength, virtue, energy, for all manifestations of agency or causal activity; and we distinguish various orders of agency by prefixing adjectives, such as physical, bodily, mental, spiritual, magical, divine.

Powerfulness, then, was primarily a human attribute, an abstract quality of man, something experienced directly in one's own efforts and less directly in the power of compulsion exerted upon one by more powerful persons;

whether that compulsion was by power applied by fist or club, or felt as radiating from the eye (the evil eye), or conveyed in words or gestures, or still more subtly. Such 'powerfulness' or power was extended by an easy step to the more interesting animals; and, by a step only less easy, to every striking natural agency which had compelling power, the torrent, the storm, the sun, the poison, the medicine, the pestilence.

¶ 6. 'POWER' AND THE POWERFUL. This was the pre-animistic stage of culture. Among many peoples such thinking seems to have led on to primitive animism, that culture in which the 'power', having been abstracted into a vague 'substance', becomes more concrete and individualised again into homuncular form, the essence of the individual being, his virtue, spirit, soul, his power of being active, of doing work; an entity which may pass from one material body to another, there to exercise its influence, working more or less intelligently and purposefully.

In the Greek culture both conceptions, that of 'power' as such and that of individualised power, the essence of active beings, the soul, survived and became rather more differentiated. The soul, or psyche, was enriched with a great variety of human attributes; while the more primitive 'power' was purified by more complete abstraction, under such names as *energeia*, *dunamis*, *storge*, *horme*, *entelechy*.

In the Latin and mediæval cultures of Europe the two conceptions became confused again and closely entangled, under such terms as animal spirits, vital spirits, varieties of

archei and of *vis*, vital force, anima. All these terms continued to carry something of the dual meaning, to imply both power in the abstract, and the individualised essence of man, the powerful being *par excellence*, the being whose agency or power of doing work was a matter of immediate experience for each man; the usage varying much from one writer to another, according as the one or other implication was the more prominent. Many of the more 'scientifically' minded, rejecting the more anthropomorphic meaning of such words as *spiritus* and *vis*, inclined to regard these as names of subtle fluids which by reason of their extreme thinness cannot be directly perceived by us through the senses and are capable of penetrating and permeating all matter.

¶ 7. POWER AND ENERGY. Such in briefest and crudest outline is the history of the early stages of genesis of our modern conception of energy. It is clear that modern man, in learning to think of energy, roughly recapitulates this history; and especially is it clear that each man's own experience of doing work, of putting out effort and thereby producing changes in the world, is the most fundamental of the concrete experiences from which, by abstraction, he arrives at conceiving of energy.

¶ 8. MOMENTUM. The great age of mechanical science was initiated by conceiving all *vis viva*, all living, active power (other than the original, the power of men and animals) as the momentum of matter in motion; and the biology of

the Nineteenth Century distinguished itself by its endeavour to make this way of conceiving energy all-inclusive. It is significant, that R. Mayer, the original exponent of the doctrine of universal conservation of energy, was not a physicist, but rather a medical man and physiologist, that his thinking was largely concerned with living organisms.

Significant of the continuity of development of our way of thinking of energy is the fact that, far into the modern period, heat and electricity were spoken of as fluids; while the two chief meanings of the word 'spirit' in contemporary English clearly point back to their common origin in the *spiritus* which was at once the breath of life, a subtle fluid allied to air, a vital spark, an essence, an agency, a power of doing work, something allied to fire, to life, to courage, to anger, to emotion in general, to will and to intellect.

¶ 9. ENERGY AN ABSTRACTION. Surely, then, it is clear from this history that energy, equally with space and time, is an abstraction; and that, therefore, the physicists who speak of energy as an entity or substance of which a fixed quantity exists now, always has existed and forever must exist, are guilty of hypostasising an abstract quality or property; that they are following all too closely in the footsteps of primitive man who abstracted the quality of powerfulness, made of it 'power' or *mana*, that which does the work, something separable from the man in whom it 'resides', and capable of 'residing' equally in Samson's hair, in the king's robe, or in the charmed ring or amulet.

This may seem a hard saying. It is easy for the layman

to understand that when the poet abstracts some human quality, such as kindliness, or fearlessness, or gratefulness, or tenderness, and makes of it (with the connivance of common speech) an entity (charity, or courage, or gratitude, or love) and then proceeds to treat of such an entity as a powerful agent, and perhaps personifies it, makes a statue or a picture of it, in male or female form, he is enjoying a poet's license; and that his usage of words is not to be understood literally. But when he is told that the physicist, in speaking of energy and in making laws of conservation of energy and so on, is taking a similar liberty, in this case an unlicensed and illegitimate liberty, the allegation may appear less obviously true.

It is worth while, therefore, to point out that psychology, which traces the history of man's thinking of energy from primitive man upwards, arrives again at the same conclusion by a different route; namely, by considering more minutely the process of abstracting by which we individually arrive at 'energy', and by reversing the process in order to retrace our steps back to the concrete experiences from which we start.

¶ 10. SENSORY EXPERIENCE. Here we must avoid being misled, as philosophers so often have been misled, by accepting visual perception as the type of all perception. In many ways visual perception is very misleading. Among other things it misleads us, if we are not on guard, into thinking of perception as a mere passive reception of a copy of the object seen, an *eidolon*, as the Greeks called it.

We see the yellow patch in the sky and say: 'I see the moon'; and the moon seems as passive in the matter as the recipient of her image. A more exact statement of the fact would be: 'I look at the moon and see her shining'. For this form of words recognises the active rôle both of subject and object. Consider auditory perception. We naturally say, I hear the bell tolling, the wind rushing, the brook babbling, the mice scampering, the cock crowing, the bull bellowing, the drum throbbing, the violin sobbing, the trumpet blaring, the man shouting, etc., etc. In every case our natural form of words expresses the fact that in perceiving we become aware of an event which is a process, an activity working upon us, in short, something acting upon us.

The same is true of perception by touch, the sense which more immediately than any other produces conviction of the reality of the object. 'Something touched my face, brushed against me, pressed upon my hand, pushed me back, resisted my effort, thrust me aside, crushed me to the ground', we naturally say, expressing the impression that something has acted upon us. And if we say: 'I touched something hard or soft', we still clearly imply an event, an exchange of energy, a reciprocal activity; for we recognise hardness or softness only through the manner in which our activity is resisted by the object.

¶ 11. BELIEF IN REALITY. You may see an object and question whether it is real, or illusory or hallucinatory, a phantom; and in order to resolve your doubt you wait for

it to touch you or to resist your touch; and, if it shows its 'power', you accept it as real; while, if it does not thus respond to your test, you reject it as phantasmal, mere appearance, a ghost, a wraith, a dream image, an illusion. Ultimately, belief in reality of any and every kind rests upon and, directly or indirectly, is induced only by, resistance to our effort, to our own striving. That which can resist us physically or otherwise, can act upon us compulsively, is the real, is believed in. Such experiences are the common root or ground of our belief in the reality of things; and not only of physical things, but of all that we regard as real. Thus the reality of the sum of the internal angles of a plane triangle is proved to us by its resistance to our efforts to make it seem other than two right angles or 180 degrees. And the reality of a man's honesty or good intentions is proved to us and made an object of belief to us by resistance to attempts to induce action of a contrary kind.[1]

¶ 12. FUNDAMENTAL EXPERIENCE OF THE 'REAL'. Psychology goes further and finds in experience a still deeper root for our belief in real things other than one's self, namely, each man's experience of himself as an enduring entity,

[1] An earlier and inadequate psychology attributed belief in reality to vividness of sensations. But this in itself involved vicious abstraction of the 'sensation' from the concrete active experience of perceiving. Compare my discussion of this important topic in my *Outline of Psychology*, London and New York, 1924, which, I believe, is the first adequate statement of the truth in this matter of such fundamental importance for all science.

something which in spite of changes remains essentially the same, feeling, perceiving, remembering, desiring, striving, failing and achieving, of variable degrees of power, but always in some degree powerful.

¶ 13. THE SELF. All belief in real things has, then, this two-fold root; first, one's experience of one's self as enduringly the same being, powerful in the sense that, though not always active, it is always capable of activity, of putting forth power. Secondly, one's experience of things (primarily persons and animals) which similarly endure and manifest to us their power by acting upon us, resisting or compelling us. In this foundation of all belief in real things we see the deepest root of primitive animism. For to primitive man, as to the child, persons are the most compelling and therefore the most real as well as the most interesting of objects; animals come near them and are conceived after the model of the person; while the inanimate thing is similarly fashioned after the person, the model of all reality, and is only gradually deprived of all attributes of persons, except endurance in space and time, and power.

CHAPTER VIII

PERCEIVING AND CONCEIVING

¶ 1. PERCEPTION IS ACTIVITY. What has been said in the previous chapter implies a truth about perception too often ignored by physicists and psychologists alike, namely, that the act of perception is shot through with thinking, involves always, not merely a receiving of impressions (call them sensations or what you will), but also an interpreting of them in terms of past experience, of modes of thinking and conceiving built up in the history of the individual and of the race. So long as the reality of Lamarckian inheritance remains questionable and denied by many biologists, we cannot confidently speak of racial memory; but, in the light of the positive results of my own prolonged experiment on this question, I have little doubt that Dr C. G. Jung is right in regarding our thinking of power or energy as one of the archetypal modes of thinking determined by racial experience and memory. But, even if this view is rejected, we shall still have to believe that the mental endowment of the race, in whatever way it has been evolved, includes, as an adaptation to its environment, facility in conceiving power, just as it includes facility in thinking of space and time.

¶ 2. BUNDLES OF SENSATIONS. An older, very defective psychology described perception as a mere conjunction of 'sensations' and 'images', ignoring the activity of the

subject; or recognising only such activity as is involved in directing the sense-organs upon the object. And this is the psychology commonly accepted by physicists (explicitly or implicitly) when they touch upon this aspect, the rôle of the subject in perceiving. But this common doctrine ignores two features of that activity; on the one hand the striving to interpret the impressions received; on the other hand, the bringing up, from the hidden resources of the mind's organisation, of the fruits of past experience and adaptation in the form of implicit knowledge and expectation.

¶ 3. ALL PERCEIVING INVOLVES THINKING. The older psychology falsely separated perception from conception as functions of two different kinds exercised separately on different occasions. In reality *all perception is also conception;* the more developed the mind and the more familiar the type of object perceived, the richer is its conceptual activity in perceiving. Thus, when the child of six visually perceives a quartz-pebble, he conceives it in the same act as a solid mass capable of being handled, thrown about, and variously treated as an enduring solid thing out there in space. And the geologist, when he visually perceives the same object, and recognises its nature, at the same moment conceives it with a fuller range of qualities answering to his implicit expectations of its behaviour in a variety of circumstances.

The tendency to conceive as a thing the object perceived, to interpret the impressions received as signs of

some enduring thing or things, is very deeply rooted. It pervades not only our perceptual activities, but also all our thinking; and manifests itself in our more imaginative and abstract thinking as the tendency to reify, to hypostasise, and even to personify; to find, behind the phenomenon or appearance, an agent, an active thing or being or substance. To whatever we distinguish by aid of a name, though it be only a moral quality or other unmistakably abstracted quality, we tend to attribute independent reality. Having achieved adjectival designation of a quality, we invent the corresponding substantive and thus, abstracting the quality into an independent object of our thinking, we tend to conceive it as an independent reality. We derive this tendency from that original ground of our belief in real things which was mentioned on an earlier page (109), namely, each man's experience of himself as an agent enduring throughout and in spite of changes suffered and experienced, the model and type of all real things.

¶ 4. PERCEIVED THINGS. A perceived thing is, then, fundamentally, not an enduring collection of sense-data in space, *sensa*, or sensations, as is so commonly asserted in terms of a bad psychology; it is rather, in the very act of perceiving, conceived as something that has not only sensory qualities, but also has power, is capable of causal activity, of producing changes, effects upon us and upon other things. And this aspect of the thing perceived is its most essential aspect; for it is that aspect which alone convinces us of its reality. Its power, power in some degree to

resist our power or to overcome it, is what compels us to believe it to be real.

¶ 5. 'CONCEPTS'. This way of conceiving things is the natural tendency of the species man founded in his mental organisation through long ages of racial adaptation and through each man's individual and direct experience of things; but it is also confirmed and standardised by the forms of language which the tendency has built up as a social heritage; it is a traditional way of thinking which, through language and suggestion, is powerfully impressed upon every individual growing up a member of the social group. That is to say each man's mode of conceiving, of thinking of, the physical world is a matter not only of individual psychology but also of social psychology; it is a product not only of racial adaptation and of his individual activities directly concerned with physical things, but also of a long process of social evolution which has established, by the aid of language, more or less standardised conventional ways of thinking.

In the misleading terminology long current, various 'concepts' have been evolved by society, concepts of space, of time, of matter, of power, and so on; somehow an exact copy of each such concept gets into the head of each member of the social group and is then applied or used by him on appropriate occasions. Concepts in this sense are fictions of a pernicious kind. There are no such entities. But the terminology does embody an important truth, though it gravely distorts it; the truth, namely, that all our ways of

thinking are products of social evolution, conventions, fashions, modes. The concept as an absolutely standardised entity, something which in some sense each man becomes possessed of and makes use of, is itself the product of the tendency to conceive every named object of our thinking, no matter how abstract (be it only a quality, property or aspect or mode of functioning) as a thing, an entity, the tendency to rëify every object of thought.

The concrete event is the act of conceiving; behind the act lies the mental organisation of the individual mind which makes possible just that act, that way of conceiving; and that organisation is peculiar to the individual; is never precisely alike in any two individuals, and never precisely the same on any two occasions of its operation in the one individual: for its every activity involves growth and change. Yet such organisation, having its history in the race, the society and the individual life, is something we infer with confidence, on amply sufficient grounds, as operative every time the individual becomes aware of the object whether in the way of sense-perception, of representative memory or imagination, or of abstract thinking in which introspection discovers no image or sensory factor. Let us then agree that, when, in the course of subsequent discussion, we use the word 'conception', we use it as a convenient short alternative to 'way of thinking', and imply not at all the ancient doctrine of the 'concept' as a metaphysical entity by 'analysis' of which we may arrive at truth.

¶ 6. SUMMARY. To sum up this disquisition on perception:

In all perceiving we are active, and what we perceive is always an event, something going on, something acting upon us; both subject and object are active in all perception.[1] Perception, then, is essentially and primarily, not perception of some static or unchanging object, but rather perception of an event or train of events which involves the causal action of some object or objects upon us.[2] The most detailed study of our sensory powers bears out this statement: there must always be interchange of energy between the object perceived and the perceiving subject. In common speech and thinking we are apt to make out of the event perceived one or more objects which we conceive as statically existing in space and as capable of entering from time to time into relations of reciprocal activity with other objects. But the concrete event involves not only space-time but also causal activity; in reality all spatial objects are in active causal relations with all others at all times. Thus the physical world is a vast continuing system of events which in every part is spatial, temporal and

[1] Again I say we must not be misled by visual perception. Where the seen object emits light, its activity is obvious. But activity of the object is not so obvious in the case of the object seen by reflected light only. Yet to reflect light is to be active, to effect an energy-change. The moon cannot shine without exerting causal agency on the light it receives from the sun and itself undergoing corresponding change.

[2] This is the fact brought clearly into view for the physicists, for the first time perhaps, by the enunciation of the Heisenberg principle that you cannot observe an electron without illuminating it and thereby entering into reciprocal action with it.

causal, is activity in space-time, is space-time-power-in-action.

Incidentally, it may be remarked, we have here the sufficient ground for regarding as mistaken all attempts (such as I take to be the emergent doctrines of those eminent philosophers Alexander and Lloyd Morgan) to evolve the world we know out of space-time (or out of some aboriginal matter inertly occupying space-time) bare of all dynamic quality, of all causal activity, whether mechanical or teleological.

CHAPTER IX

FORCE AND ENERGY IN NATURE

¶ 1. REALITY OF 'ENERGY'. In the light of our discussion of perception in the foregoing chapter we can now approach some questions which, by the use of the word 'power', we have hitherto avoided, namely, the nature and validity of the modern distinction between force and energy, and the status of force and of energy in the real world. The word 'power' has been used in this discussion hitherto, because it best represents the undifferentiated thinking that continued until, about a hundred years ago, energy and force became clearly distinguished. About the same time the principle of the conservation of energy was propounded and rapidly gained general acceptance.

¶ 2. POWER, ACTUAL AND LATENT. It cannot be said that before that date force and energy were not in any degree distinguished. Men did distinguish between them as power at work and as power held in reserve; but the distinction was not clearly and generally made and was not fixed by the use of well-differentiated words.[1] It was the principle

[1] This stage of thinking is well illustrated by the following passage from the writings of Faraday: "I have long held the opinion, almost amounting to a conviction . . . that the various forms under which the *forces* of matter are made manifest have one common origin; or, in other words, are so directly related and mutually dependent that they are convertible, *as it were*, into one another, and possess equivalents of *power* in their *action*. In modern times the proofs of their

of conservation of power and the experiments which supported it that led to the rapid and clear differentiation of the two conceptions. Men had long recognised the difference between putting out effort and holding it in reserve. The former was commonly called 'exerting force'; and, when the force was exerted in opposition to the exertions of another man, that other was credited with a similar activity of exerting force; the man whose effort overcame the opposition of the other man was said to exert the greater force. Sometimes, in thus exerting himself, a man was conscious that he was not exerting himself to the full, that he could, if he so desired, exert a greater force: it might be that he playfully allowed himself to be overcome, or that he felt disinclined to exert himself fully, the effect aimed at being not strongly desired, a greater effort therefore not 'worth while'. Power, then, could be held in reserve by each man.

When a man applied his force to an animal, the facts seemed entirely similar; the animal might put forth in opposition a smaller or larger force according to the circumstances, especially the incentives of the moment.

With inanimate things the case was somewhat different. Every heavy object resisted the force exerted to lift it, until that force, increasingly exerted, reached a certain intensity; and then it yielded; there were no appreciable variations of the amount or degree of resistance. It was

convertibility have been accumulated to a very considerable extent, and a commencement made of their *equivalent forces*". (I cite this passage after Prof. Eve, and have italicised, as in subsequent citations also, some of the words of most interest for the present discussion).

said that there was a certain force of attraction between the object and the earth, the measure of which was called its weight. On the other hand, an elastic rod of wood or metal, firmly fixed to the earth at one end, could be bent by the application of force to the other; and the more it was bent, the greater force did it exert in opposition. In both cases the opposing force was directly experienced by the man applying force to move or bend the object. By bearing down with the fist on any resisting object, a man could produce a certain degree of effect; but by bringing down his fist rapidly to strike the object, he could produce a greater effect; he somehow concentrates the force he exerts. And by using a hammer he could further magnify the effect produced.

¶ 3. FORCE AS EXPERIENCED CAUSE. Force, then, was and is experienced most directly and intimately in our own efforts; less directly in the compulsion which other men, animals, and things exert upon us, resisting or restricting our efforts to move, or moving us or our limbs in spite of our resistance. *Force was cause as experienced;* primarily one's own causal efficacy; secondarily, that of other persons and animals; thirdly, that of inanimate things. The force exerted by me was the cause of your falling to your knees; and the force exerted by you and felt by me to be greater than mine, was the cause of my succumbing. Force was cause in action, causal activity experienced in more immediate and intimate fashion than any object of sense-perception, but perceived also directly and indirectly

through the senses, and conceived in the light of many such experiences.

¶ 4. LAWS OF PHYSICAL FORCES. Newton had introduced order and lawfulness into men's thinking about forces; and, in doing so, had rendered mechanics an exact science. The famous three laws, commonly called his laws of motion, are, more properly, laws of forces affecting motion, the causes of motion and change of motion. But though Newton had made more definite the conception of force as the cause of acceleration or change of motion, force remained subtle and elusive; it remained a property of things, rather than a thing or independent entity or existent. There were attempts to conceive it in that way; but they remained unsuccessful until the differentiation of force and energy was achieved in the early Nineteenth Century.

It was the hey-day of mechanical physics, of the theory that the physical universe can be adequately described as a vast system of particles of matter in motion and all its changes as accelerations caused by the communication of motion on impact. All real causes were such impacts, the force exerted by one mass in motion upon another. Only the phenomena of gravitation seemed to escape this generalisation; and to some physicists the hypothesis of Le Sage seemed to abolish that last exception.

¶ 5. EQUIVALENCE OF ENERGIES. Experiments showed that work done in raising a heavy mass could be largely recovered; the raised mass could do nearly as much work

as had been done in raising it, could, in falling, raise an equal mass to the same height, or a mass half as great to twice the height. And the more nearly, in such experiments, friction was reduced to zero, the more nearly exact was the equivalence. But in all such cases some power-of-doing-work was lost, and commonly much was lost. What became of it? The kinetic theory of heat supplied the answer. Heat, which had been regarded as a subtle fluid, became a 'mode of motion'; became the momentum of the molecules of which all matter was composed bounding to and fro within it. Joule's experiments showed the constancy of the amount of rise of temperature of water when agitated by the doing of a given amount of work upon it. Rumford's observations on the rise of temperature caused by the boring of cannon showed similar constancy or equivalence.

¶ 6. MECHANICAL INTERPRETATION OF FORCE. These and other experiments showed the near constancy of power-of-doing-work possessed by any relatively closed physical system in spite of all changes within it. Here was a quantity, namely *work done*, that could be measured in such terms as foot-pounds; and the system which had done a given amount of work was credited with having possessed *the power to do that work*. When a system had done a certain amount of work, it was found that its power-of-doing-work was correspondingly diminished; and the same amount could be found to have been added to the system on which the work was done. All work done was regarded

as acceleration, and all cause of acceleration was momentum transmitted; and what momentum was lost by the cause was gained in the effect. In any process of change the total of momentum is unchanged; the amount of momentum is merely redistributed among the masses concerned and is conserved. Force, the cause of change of motion, is transmission of momentum.

Under this view what we directly perceive as force is the impact of masses in motion against us; such impact imparts momentum to our tissues, which in turn stimulates the 'muscular sense', excites sensations of strain or movement, and thus is perceived. The mystery of force and causation was regarded as solved in principle.

For the power to do work possessed by a solid mass in motion seemed thoroughly intelligible; it could, by impact, set another mass in motion, do work upon it. These were facts of a kind familiar to every man through many experiences of working and of being worked upon, of exerting force and of being forced to move. Momentum as a power of doing work was intelligible; and communication of momentum by impact was intelligible. If momentum and its communication could be regarded as the cause of all physical change, physics would be completely mechanical and all physical processes intelligible, explicable in these familiar terms. To show that this was true doctrine became the hope of the physicist; that it could and would somehow be shown to be true became his faith.

Throughout the Nineteenth Century and beyond, physicists for the most part continued to hold this as an

ideal scheme of the physical world; applying the eye of faith to all such phenomena as would not readily lend themselves to interpretation in terms of it. And many biologists accepted it as established truth to which all their own interpretations must conform.

¶ 7. RECALCITRANT PHENOMENA. Now, if this scheme had proved all-sufficient and satisfactory, the conception of energy would not have been needed; momentum would have sufficed. Force likewise would have become merely another name for impact of masses in motion; and all would have been smooth sailing; all mysteries and mysticism would have been abolished from science. It was the lure of such abolition that held so many men of science true to their faith in the mechanical theory.

But some, indeed many, phenomena remained recalcitrant. First and foremost gravitation; for the hypothesis of Le Sage was extravagant and unsupported by any experiment. Then there were the facts of chemical transformation resulting often in great heat and momentum of masses. Again there was elastic strain or tension as of a compressed spring. And above all there were the electromagnetic phenomena just coming into prominence through the work of Faraday; especially the fields of force he postulated.

These forms of the power-of-doing-work could not immediately be shown to be forms of momentum. Yet the principle of conservation of the power-of-doing-work was found in numerous experiments to hold good of such

processes also. Power-of-doing-work was not lost in any of them it seemed, but only transferred from one system to another. Hence a word more general than momentum was required to denote that which was conserved, the power of doing work; and 'energy' was the word chosen.

¶ 8. POTENTIAL ENERGY. Pending the demonstration, so generally hoped for, that all energy was momentum, some term was required to distinguish energy that was not clearly momentum from energy that was; potential energy (or 'latent energy') was the term chosen. Since the energy of the heavy mass raised on high was the most conspicuous of these forms of latent energy; and since all other forms of potential energy seemed somehow bound up with special distributions of matter in space, they were provisionally labelled forms of 'positional energy'.

Energy was, then, conceived as a relatively independent constituent of the physical world. It had various relations to matter; but matter was one kind of existent or real being, and energy was another. Indeed for many physicists energy became more real than matter, space or mass; it became the most fundamental, the most indispensable, postulate. Ostwald, with a considerable following (1902), proposed to dispense with matter entirely and to regard the physical universe as consisting of energies of various kinds. And this general tendency persists. In an essay of 1934 a physicist (Eve) speaks of "the established idea that the physical universe is a manifestation of energy in various forms".

¶ 9. PROFESSOR SODDY ON FORCE AND ENERGY. But, rather than cite a number of such illustrations, it will be more instructive to examine the exposition of a single representative physicist; one who is by no means a dogmatic mechanist, but rather is markedly open-minded and a leader of 'the new physics'. I choose for this purpose an exposition written by Prof. F. Soddy some fifteen or twenty years ago,[1] that is to say in the transition period when the new physics was only beginning to take shape. First, we notice that our author is not one of those who seek to escape dynamic problems by asserting that science has no concern with explanation and causation and must confine itself to description. He believes in causation and even in 'real causes'. Nor is he an idealist, in the sense of regarding the physical world as only a projection of mind. He speaks of "the invisible real world of molecules" and of "real causes". Further: "We must make up our minds to accept the existence of as few fundamental things as possible which cannot be explained in terms of anything else". Of such 'fundamental existences' physical science, he says, recognises at least three, Matter, Electricity, and Energy. "Energy is recognized in two forms, kinetic and potential. The first *depends* on motion, the second on the position of the body under consideration". "Energy may sleep indefinitely in matter, in one of its numerous potential forms, without any indication of its presence. It is only

[1] Unfortunately on the book from which I cite, *Matter and Energy* (Home University Library) I can find no date. The italics throughout are mine.

perceptible when in the kinetic form as mechanical energy or the kinetic energy of moving masses, as electrical energy or the kinetic energy of moving electrons, and so on".

In this last passage we note that energy is 'perceptible' when in the kinetic form. Surely a strange and highly disputable proposition. We can perceive motion and various spatial and temporal relations, and force, and various qualities of things such as tones and odours. But do we and can we ever perceive energy? Is it not true that we always and only *infer* energy from work done, from various changes perceived, such as change of motion, change of position.

¶. 10. FORCE: AN ANTHROPOMORPHIC FICTION. Forces, which Newton and Faraday regarded as very real and some of which we do directly perceive, Soddy puts aside as anthropomorphic fictions, purely "imaginary causes of change of motion". This contemptuous dismissal of all forces as unreal, as purely fictitious (common enough among men of science) is a little difficult to understand on the part of a physicist who regards energy as an independently existing reality. "Before the doctrine of its conservation was established, energy was mysterious and unaccountable in its comings and goings. Today it is no longer a mystery". It is a "definite fundamental existence". It is "one of the fundamental physical existences. Its recognition, as a *separate entity*, distinguishes the present age from all its predecessors. This is the Age of Energy". On which we can hardly refrain from commenting: Entity

is good! Force on the other hand is heaped with contumely: "the idea of force . . . has confused the issues and retarded the growth of science to an almost incalculable extent".[1] Which seems hard on forces, considering their immense services in the form of Newton's laws of motion.

"The very idea of force is, however, what would be termed an anthropomorphism, that is to say, it ascribes the behaviour of inanimate objects to causes derived from the behaviour of human beings". Yet it is certain that all conception of cause is anthropomorphic and that energy is an anthropomorphism in the same sense as force; only, one might say, more so. We have seen how our conception of power, founded in our own experience of putting out power, became differentiated into the conceptions of force and energy. And of the two, force, being, as we have seen, directly perceived and immediately experienced, is less inferential than energy, which is wholly inferential; in spite of Soddy's urging that we should "try to grasp the meaning of energy as a fundamental *fact of experience*".

Why so much contempt for forces and so much esteem for energy? The answer seems to be—conservation.

"Gradually this Law of Conservation has supplied the physicist with an experimental test of reality in a changing universe. What appears and disappears mysteriously, giving us no clue of its origin or destination, is outside of

[1] Here we have the interesting case that while force is purely fictitious, the *idea of force* has great causal efficacy to retard the growth of science. One might put it that, while force has no force, the idea of force has much force.

his province. To him it has no physical existence. What is conserved has physical existence, whether it is tangible and ponderable like matter, or intangible and imponderable like energy. . . . Forces are not conserved, they have no physical existence".

Energy, on the other hand, is conserved, and therefore exists:

"Not until the law of conservation of energy was established, and it was shown that energy like matter is indestructible and uncreatable, could energy be regarded as one of the *fundamental physical existences*".

Again:

"Deep down somewhere in the processes of thought the ultimate test of reality appears to be the Law of Conservation. Does the soul exist? If so, it must be immortal. Is matter real or a mere impression of the mind? It cannot be created or destroyed, and therefore has an existence apart from mind. Lastly, has energy a specific existence, or is it merely a convenient abstraction? Energy is conserved like matter, and therefore obeys this test of objective existence".

¶. 11. 'TRACTATION' AND 'PELLATION'. So strong is Soddy's aversion from forces that he will not allow us to speak of forces of attraction and repulsion acting from atom to atom or between electrons and protons, as the causes of acceleration. Instead we must say that an electron and a proton *tractate* towards one another, while two electrons *pellate* away from one another. It is their nature so to do and that is all we know about such matters, and all we need to know. In the same way, we must not speak of a force of

attraction between the earth and the falling body, nor of traction of each on the other; rather, the earth and the falling body merely tractate towards one another.

¶. 12. REAL CAUSES. Yet Soddy believes in *real causes* of motion. He is neither a purely descriptive scientist, like Lloyd Morgan; nor one of the pure fictionists, like Needham.

"Why two bodies tractate or pellate is not known in a single instance, least of all perhaps in the oldest recognised case, gravitation. An ingenious theory of gravitation was put forward a century ago (Le Sage's) which, though not accepted, is very suggestive, and illustrates the difference between *what science would consider a real cause* and one that is fictitious, like the 'force of gravity'. . . . It traces gravitation to imaginary corpuscles, but, if it is correct, these corpuscles are real. . . . In this sense it is an attempt to find a *real cause*".

From which it seems clear that, for Soddy, at the date of writing this book, the only *real causes* are the impacts of moving masses.

Here we see clearly the cloven hoof of the mechanistic dogma, favourite child of the Nineteenth Century. It seems that we must go on seeking to find such 'real causes' for all effects. "Frankly it must be admitted, however, that the real causes of tractation and pellation are unknown, though not necessarily unknowable. That being so, we accept the observed phenomena as facts, and find out all we can as to how they *operate*". From which it seems that

tractation and pellation operate, and therefore become strangely like the contemned forces they replace. Yet again, perhaps it is not tractation and pellation themselves which operate, but only the laws which govern them. For, we are told: "The law of gravitation *acts* universally on matter endowing it with weight due to the tractation of the matter towards the immense mass of the earth".

It will be said that we must not take this last sentence literally; it is a momentary lapse into colloquial speech; and there are extenuating circumstances. Yes, indeed, such anthropomorphisms (as laws acting and operating and endowing matter with weight) flit through the pages of the physicists; but they ill befit the purist who forbids us to speak of forces of attraction and repulsion. The extenuating circumstances are that he is expounding the physical thinking of a period when it was in transition and confusion between the old or purely mechanical and the new or geometrical physics.

¶ 13. CONFUSION. The same author who has clearly intimated his belief that all physical causes are mechanical (kinetic) and refuses to recognise forces of attraction and repulsion, tells us that "an electron is an electric charge which, *if not prevented*, pellates from other similar electrons . . . and tractates towards positive charges. The *intensity* of the *effect* varies, like that of gravitation, [so gravitation produces effects] inversely as the square of the distance. If a collection of electrons is brought near an uncharged mass of matter of finite size, the electrons in the matter

pellate to the further side, leaving the side nearest to the electrons positively charged (by induction as it is called). The opposite charges being nearer than the like charges, the tractation *overpowers* the pellation". From which it appears again that pellation and traction are forces or causes of motion, forces that may conflict, one with another; they seem, indeed, to be the very forces for the obviation of which they were invented.

But our author, of course, would deny that pellation and tractation are causes of motion (or of anything else) and, in that sense, forces. Why then is he not content to speak of the motion of particles towards or away from one another; to say that it is the nature of particles or masses of matter to move towards one another, of electrons (and of protons) to move away from one another; and the nature of electrons and of protons to move towards one another?

There is a very good reason, or rather two good reasons, both of which are indicated in the passage last cited. The description would be inadequate in two respects. Take the case of any heavy body B. How can we most simply describe the observed facts implied by the word 'gravitation'? We may say: 'This B (like every other B to which appropriate observation has been directed) moves towards the centre of the earth, *when not prevented*'; and then, by an inductive generalisation, we infer that all Bs move similarly. But there is more to the facts observed than is here stated. B not only moves, but moves with a constant acceleration, an acceleration which is the same for every falling B. Secondly, we cannot give a general description

of the facts without using the phrase 'if not prevented' or some equivalent of it. Suppose then you *prevent* the movement by hanging B to the end of a spring balance. The spring is extended to a certain degree before the movement of B ceases. You cannot describe the facts wholly in terms of movement observed (of tractation). Over and above the fact of movement, is the cessation of movement; and further the fact that, when the movement has ceased, the spring remains extended *so long as* B remains attached to it; and shortens as soon as B is detached. B in moving has produced an effect upon the spring (extended it); and, during the period of no movement, B maintains the effect. During this period of no movement, B is neither tractating nor pellating. The facts therefore cannot be described in terms of tractation (or directed movement) alone.

Or suppose that in place of the spring, you use your hand to *prevent* the tractation of B; B weighs, let us say, ten pounds, and you hold it in the upturned palm of your hand, the arm horizontal. You are aware of putting out force to *prevent* the tractation of B. You resolve to hold it there for ten minutes; the weight thrusts downward against your hand; you feel it pressing down; you are aware of making the effort of innervation of your deltoid muscle required to counteract this thrust. As the minutes go by, you find you require to make an increasingly great effort to maintain the required contraction of the deltoid muscle. And at the end of the ten (perhaps two) minutes, you feel utterly 'done'; your power to maintain the effort which counteracts the thrust of the weight seems exhausted.

You fall on a couch to rest, and to let your heart and lungs resume their usual quiet action. The physicist, standing by, says, 'Pooh, pooh, you can't be tired, you have done no work'. But you have the immediate experience of fatigue, and cannot be argued out of the conviction that you were active during those ten minutes, doing *something* pretty strenuously, namely *preventing* the *tractation* of B, and that B was *acting* upon your hand, thrusting at it in the downward direction.

¶. 14. ALL OUR EXPERIENCE ANTHROPOMORPHIC. Such are the experiences on which 'the force of gravity' is founded; and there is no getting away from this foundation in experience. It is anthropomorphic; but, unfortunately, all our experience suffers from this same incurable defect; even the physicist in all his glory remains an anthropomorph. The physicist tells you that *your* experience was of 'the visible seeming world of gross masses'; that *he* is concerned with 'the invisible real world of molecules'; and that, in terms of that 'real' world, the facts are that the molecules of which B is composed were battering against your hand in the downward direction, thus being *real causes* of your experience of a downward thrust to which you responded with an equal upward thrust of your hand. Now you may, like most laymen, be ignorant of the fact that the rigidity of solid masses is something that remains quite unexplained by physics; and therefore may meekly accept this account. But you may still persist in wishing to understand why the molecules make this concerted down-

ward attack. The case is not in principle different whether you are dealing with a single molecule or with many.

You take your mass, B, (whether a single molecule or many) and throw it straight upward. It rises with a diminishing velocity, turns back, retraces its path with increasing velocity and returns to your palm with a bang, a downward momentum directly perceived by you as a thrust towards the earth. Your thrust (directly experienced as force exerted by you) caused it to move upward; and nothing will convince you that some agency or force, some active cause, was not at work to turn it back from its upward flight and give it its downward momentum. To the question: 'What is the cause'? or—'What force (or forces) brings about this reversal of momentum?' Soddy has no answer; or his book of twenty years ago had none.

¶ 15. PHYSICAL FORCES STILL POSTULATED. The new physicist will tell you that Einstein has shown that what we call the phenomena of gravitation are due to a curvature of space-time. If you are not markedly suggestible, you refuse this geometrical explanation of a dynamic experience. No curvature of space-time will account for the reversal of B's direction of movement, the conversion of momentum in one direction into its opposite. When you cause the momentum upward, you are immediately aware of exerting force; the opposite reversal, from upward to downward momentum, must imply something of the same nature, some force directed downward. And, if your physicist

persists in pooh-poohing your imaginary force of attraction, you point out that the most up-to-date new physics still postulates forces of attraction between electrons and forces of repulsion between elections and protons, even asserts that 'an electron must, in a certain sense at least, occupy the whole of space'; for 'no matter how far we retreat from an electrified particle, we cannot get outside the range of its attractions and repulsions'.[1] Also the new physics still postulates fields of electro-magnetic influence which, quite in the style of physics before the differentiation of energy and force from power, are variously called by its representatives 'fields of force' and 'fields of energy'. And Soddy himself does not avoid the postulation of force (in connexion with electro-magnetic processes) where there is no question of impact of particles.[2]

Or perhaps Soddy will admit that tractation is not

[1] Sir J. Jeans; *The Mysterious Universe,* London, 1932.

[2] In the same book he freely assumes fields of energy: "The relations between the electron and the external field of energy which attends its motion are perfectly reciprocal. On the one hand, the electron cannot move from rest without this attendant field of energy around it coming into existence, and cannot be stopped without the attendant field of energy disappearing from the ether". Such fields of energy are described by other physicists as fields of force. Soddy avoids this anthropomorphism, but writes very anthropomorphically of electrons: "The space around an electron at rest becomes endowed with energy when the electron moves, and before the electron can again be stopped this energy must be withdrawn". . . . "A stream of electrons flowing at right angles across a magnetic line *experiences* a sideways thrust in a direction at right angles both to its original path and to the magnetic line of force".

adequately described as motion, and that it involves also tendency to motion when B is at rest. But the 'tendency' must be admitted to be something positive, something directly perceptible; it is the 'tendency' of the mass B towards the earth which I perceive as I strive to prevent the 'tendency' from passing into movement. Soddy admits that, in tractation, bodies acquire kinetic energy. "In each process the appearance of kinetic energy accompanies the change of position. Hence the bodies in their original position, though possibly possessing no kinetic energy, have energy, if energy is real and not a delusion, which is associated with their position. This is what is meant by potential energy". This surely is an indefensible statement. If the energy which appears as kinetic energy when B begins to fall existed before that moment while B was at rest, it was not *possessed* by B; it was rather a function of the position of B relatively to the centre of the earth, and must be said to have been part of the total system of which B is an insignificant member. To say that it was possessed by B at rest, and that more and more of it changes into kinetic energy of B, as B approaches the centre of the earth, is a fanciful and misleading description; for it ignores the relation between the tractating bodies, a relation which is not merely geometrical, but is essentially dynamic.

Perhaps I have said enough to illustrate the difficulties and the deficiencies of the physics of the transition period, to illustrate also the fact that the differentiation of power into force and energy is by no means clear cut and complete.

We shall go on to examine more nearly in the following

chapter the claim that energy is a separate existence, an entity, a definite fundamental existence, or, to be frank, a substance.[1]

[1] For that is what it amounts to, as Soddy's language and that of many other physicists makes clear, although they mostly are careful to avoid the word. R. Mayer, the father of the law of conservation, spoke of energy as "a unitary and indestructible object". Turning to the current text-books of physics I find energy described as "something possessing such a real, concrete, independent existence that it can even be stored away for hours or for centuries and then set into action"; and it is said that "a body may receive and hold energy"; that "the total amount of energy in existence remains constant". And Jeans speaks of energy as "the fundamental entity of the universe".

CHAPTER X

IS ENERGY AN INDEPENDENT EXISTENT?

¶ 1. THE CONSERVATION OF ENERGY. Energy is conserved we are told. The total quantity in the universe remains the same through all changes and all time; but there are various forms of energy (the most mechanical physicist recognises at least two forms, kinetic and potential) capable of being converted one into another. This story of the conversion of an entity, a fundamental existent, from one form to another smacks too much of magic, or of *Alice in Wonderland*, and should give us pause.

What is it that is conserved? Soddy raises this question explicitly; and his reply to it is surprising. What is conserved, it appears, is not any entity, not even velocity of some body, but 'the square of the velocity'. This answer of course applies only to kinetic energy, the one form in respect of which the meaning of the conservation-proposition seems relatively clear. But clearly the square of a velocity is not an independent entity.

¶ 2. POSITIONAL ENERGY. The case is still more obscure when we consider positional energy. Take the case of a well-balanced frictionless see-saw carrying weights A and B at its extremities. One end A goes up and the other B down. What has been conserved? Not any velocity, and not any position or system of positions. There is, to use the abstract language usual in mechanics, first, a system of

three masses (A, B, and the earth) in certain spatial relations; then the same three bodies in other spatial relations. Neither velocities nor positions are conserved; but there is equivalence in a certain respect between the two systems, namely, in respect of 'capacity to bring forth changes', of capacity to cause effects, 'of ability to perform work'.

Approach the problem in its most intelligible form in the simplest way. You have a moving mass, say a falling cricket-ball. We say it has kinetic energy. But is the energy something that exists over and above the concrete reality of the ball in motion? We perceive the ball and we perceive that it moves. And we can for certain purposes legitimately abstract its motion, can describe and discuss the motion, the path through space and the velocity, neglecting all other properties of the ball or characters of the event. But we do not perceive the energy of the system. How, then, can we legitimately abstract the energy as we abstract the motion? The concrete event is the mass in changing relations of space and time (or of Space-time). When we abstract analytically the properties of an object or event, we can by putting them together in imagination reconstitute the object. Now, when we thus treat the event, the moving ball, we first analyse it into (abstract from it) the material object with its many properties *and* its motion in space-time. Nowhere do we find energy as something over and above these products of analysis. We then reconstitute the event by synthesis of these properties and this motion; and lo! the energy is there again.

¶ 3. CONTRADICTIONS. If the reader is still unconvinced, as is probable (for beliefs established by nothing more than suggestion have a wonderful tenacity) let him consider the following mess to which the commonly accepted doctrine of energy commits us. Energy is (quantity of) ability to perform work. All energy is tending to conversion into the form of energy called entropy, according to the inescapable second law. Eventually, all energy must take this form. The quantity of energy, having been strictly conserved, will then be still the same; but all performance of work will be impossible; there will be in the universe no ability to perform work. That is to say the universe will contain the same immense quantity of ability to perform work as at the present moment; but it will at the same time contain no ability to perform work. This is a very simple putting together of assertions which usually are kept carefully apart. It should from the first have been obvious that there must be some radical flaw in a way of thinking which leads to absurd or self-contradictory conclusions. Yet the law of entropy (the second law of thermo-dynamics) is, we are frequently told, the most solidly established of all physical laws; and even those physicists who, like Eddington and Jeans, most delight in throwing everything into the melting-pot, stand upon the law of entropy as on one solid rock in a dissolving world, basing stupendous conclusions on this intrinsic contradiction.

When the physicist finds himself getting to a point in his exposition where such absurd conclusions begin to

loom, he commonly rides off on the plea that of course it is impossible to express these profundities in other than mathematical language.

¶ 4. ENERGY PRESUPPOSES SOME SYSTEM OF RELATIONS. The simple truth (ignored or denied by the doctrine that energy is an independent entity, substance or existent in its own right) is that energy or 'ability to perform work' depends upon, is a function of, various relations which are ignored in the vicious abstraction ending in the hypostatisation which gives such 'energy'. In the final state when all energy is lost, or converted into entropy, that form of energy which by definition is not energy, the requisite relations no longer obtain; as *e.g.*, the relation of higher and lower in the temperature scale or in reference to the centre of gravitation.

¶ 5. CONSERVATION OF ENERGY TACITLY REJECTED. Consider further the fate of the law of conservation of energy which for nearly a century has been regarded as one of the best established truths of science. Thirty years ago anyone who was inclined to scepticism in respect of it and who argued (as I did in my *Body and Mind* and elsewhere) that the 'law' does not warrant us in relegating mind to a status of quasi-reality, complete impotence, and innocuous desuetude, in denying that mental activity has causal efficacy of any kind, has the slightest influence on the course of events; any such person was regarded as an imbecile or an ignorant crank, at best as a person deluded and misled

by superstition. Yet to-day, although I have not found the fact acknowledged frankly by any physicist, the law of conservation of energy has gone the way of so many immutable laws. For it is common doctrine that matter is convertible into energy, that mass varies with velocity, that length or distance and velocity and mass are all relative. Even kinetic energy therefore is a relative and uncertain quantity. In place of the dogmas asserting the conservation of matter, of mass, of energy, and of momentum, we have such vague statements as the following: "One *simple* fundamental *entity*, which may take many forms, matter and radiation in particular, is conserved through all changes; the sum total of this entity forms the whole activity of the universe, which does not change its total quantity"[1] (Jeans). On which magnificent piece of dogmatism one can comment with one word only—Perhaps.

¶ 6. ENERGY AND THE NEW PHYSICS. The psychological approach to the problem of energy teaches us, then, that 'energy' is arrived at by a process of illegitimate abstraction, therefore a fiction; and that the difficulties of the problem are not to be solved by carrying this process of abstraction to yet greater extremes. Yet that is just the line which the physicists seem inclined to follow; the remedy for excessive abstraction is more abstraction, they seem to say. Sir J. Jeans, for example, exhibits vividly some of the difficulties and contradictions involved in the various accounts of energy rendered by physics: "the

[1] *Op. cit.*

attempt to parcel out energy amongst the different parts of space leads to an ambiguity which cannot be resolved. It seems natural to suppose that our attempt is a misguided one, that the partition of energy through space is illusory. And again, the attempt to regard the flow of energy as a concrete stream always defeats itself—leads to absurdities and contradictions". He recommends the mathematician's way, which is to treat energy itself[1] as a mere mathematical abstraction; and concludes that "the propagation of energy, such as the passage of sunlight from sun to earth, now reduces to nothing more than the continuity of a corrugated crumpling along a line in the continuum of space-time".[2] Jeans' proposal to pool all the laws of conservation into a law of conservation of 'one simple fundamental entity' has already been cited. Putting these statements together, we now see that for Jeans what is conserved is 'a mere mathematical abstraction' which is, nevertheless, a welter of 'corrugated crumplings of space-time'.

Finding the mechanical account of the physical world utterly unsatisfactory, and failing to see that this is by reason of the highly abstract nature of that account, Jeans proposes to replace it by the still more highly abstract account of the mathematician. "The final truth about a phenomenon", he writes, "resides in the mathematical description of it; so long as there is no imperfection in this, our knowledge of the phenomenon is *complete*".

[1] Elsewhere in the same book described as "the fundamental entity of the universe".

[2] *Op. cit.*

Surely, a vary naïve statement of a mathematician who, like all good tradesmen, believes that 'there's nothing like leather'. For, as another mathematician, S. D. Birkhoff, truly says, "all abstractions are provisional and partial aspects of the truth"; they "represent only a part of the truth, with limited sharpness of focus".[1] And yet another warns his fellow mathematicians against error of this kind: "Its very success however has led some of its adherents to confuse mathematics, the mere handmaiden of experiment, with science, the master himself. The mathematical method is admittedly an invaluable weapon of search, but the validity of its final conclusions is severely circumscribed both by the nature of the initial assumption and the process itself".[2]

¶ 7. CAN GEOMETRY TAKE THE PLACE OF DYNAMICS? The tendency expressed by Jeans in the passages cited in the foregoing paragraph is a main tendency of the new physics, the tendency to geometrise, to replace dynamics by geometry; as when we are told that gravity and gravitation are replaced by a curvature of space-time; or when Eddington, in spite of his virtuous inclination to recognise the dynamic aspect of physical reality, asks us to regard the physical world as a system of pointer-readings. Yet there is another and a better tendency also clearly expressed in the new physics, the opposite of the tendency to carry abstraction to the extreme at which words are deprived of

[1] *Science To-day*; London, 1934.

[2] Prof. H. Levy; *The Universe of Science*; London, 1932.

all meaning; namely, the tendency to undo some of the abstraction, to return closer to the concrete facts of observation.

¶ 8. 'ACTION', A RETURN TO THE CONCRETE. Of this tendency the quantum of action (stated in Planck's formula as h) is the clearest expression. The quantum of action is, in the four-dimensional world, says Eddington, the analogue of energy in the old discarded world of three dimensions. And he tells us that it is an absolute quantity, apparently the only absolute in an otherwise relative world (for even the speed of light is relative when every standard of length is relative).

This quantity, recognised by the new physics under the name of 'action', is less abstract than energy, matter, or time-space; it has, says the same authority, two ingredients, energy and time. In other words, and more strictly, instead of abstracting from causality, as does the geometrising tendency, this better tendency acknowledges causal agency as of the essence of all real events and binds up this aspect of events, the dynamic aspect, with the spatial and temporal aspects, as inseparable aspects of all physical events. However this virtue would seem to escape the notice of Eddington who, true to the abstracting atomising tradition, describes 'action' as consisting of atoms of a new kind, atoms of 'action', and 'action' itself as a new kind of entity.

Nevertheless, in spite of this dubious description of 'action' as an entity, the recognition of 'action' does represent the undoing of the abstraction by way of which power,

causal efficacy, influence, activity, the universal causal bond uniting all physical events (without which the physical world has no reality) was taken away from concrete reality and made into a separate entity, energy.

I am acquainted with only two authors whose treatment of physical reality embodies in large measure the consequences which, as I have tried to hint in the foregoing pages, must follow from recognising the fundamental problems of physics as problems of the frontier between physics and psychology. Neither of these is a psychologist, and neither acknowledges fully the necessary role of psychology; one is a logician, the other a mathematician.[1]

¶ 9. CASSIRER. Prof. Ernst Cassirer[2] writes: "It is the task of physical investigation to advance from these sensuous measures (spatial and temporal) which are satisfactory for practical purposes, to the realities indicated and expressed through them". And: "Necessary as are space and time in the construction of empirical reality, they are after all only the universal forms in which it is represented. . . . A new principle is needed to fill these empty forms with concrete content. This principle has been conceived in different ways . . . until its final logical definition in the modern conception of energy. Here, for the first time, we seem to have the ground of reality under our feet.

[1] They are the only two authors known to me who discuss the physicists' problem of energy with sufficient psychological insight to avoid writing nonsense.

[2] *Substance and Function*; London, 1923.

Here we have a *being* that fulfills all the conditions of true and independent existence, since it is indestructible and eternal". While

"the *atom* and matter . . . are reduced to mere abstractions through the closer analysis of the data and conditions of our knowledge . . . in energy we grasp the real because it is the effective. Here no mere symbol comes between us and the physical thing; here we are no longer in the realm of mere thought, but in the realm of being. And in order to grasp this *ultimate being*, we need no circuitous route through complicated mathematical hypotheses, since it is directly revealed unsought in perception itself. What we sense is not the doubtful and in itself entirely indefinite *matter*, that we assume as the 'bearer' of sensuous properties—but it is the concrete effect, which is worked on us by outer things".

Here Cassirer may seem to be falling into the abstraction—error. But he goes on to qualify this exposition of energism by further valid psychological thinking: "The notion that 'energies' can be seen or heard is obviously no less naive than the notion that the matter of theoretical physics can be directly touched and grasped with the hands. What is given are qualitative differences of sensation; of warm and cold, light and dark, sweet and bitter, but not numerical differences of quantities of work". And: "The object means more than a mere sum of properties; it means the *unity* of the properties, and thus their reciprocal dependency". But:

"Conceived as a particular thing, energy would be a somewhat, which was at once motion and heat, magnetism

and electricity, and yet also none of all these. As a principle, it signifies nothing but an intellectual point of view, from which all these phenomena can be measured, and thus brought into one system in spite of all sensuous diversity". . . . "If we clothed the principle itself, which demands the definite quantitative correlation of the totality of phenomena, in the form of a particular thing, even in the form of 'the' thing, the all inclusive substance [the 'one simple fundamental entity' of Jeans], we should create the same dogmatic confusion that energism charges against materialism. Science at least knows nothing of such a transformation into substance".

Energy signifies

"nothing else than the capacity to bring forth changes; and this capacity is the most universal determination that we can distinguish in the bodies of our world of perception, and without it they would cease to be physical phenomena for us . . . the most general property by which the objects of physical reality are distinguished is the capacity to produce and to receive effects. Things first gain their real objective character, when they are conceived as members of actual or possible *causal relations*".

But we must not regard energy as a *property* common to all bodies, as spread throughout the physical universe, and somehow attaching to every body; it is rather 'a highest common *standard of measurement* for all changes in general' and is a 'relational concept'. "Energy is able to institute an order among the totality of phenomena, because it itself is on the same plane with no one of them; because, *lacking all concrete existence*, energy only expresses a pure relation of mutual dependency".

Thus Cassirer comes nearer to a satisfactory account of energy than any of the physicists, because his thinking is more psychological. But he is handicapped by some of the traditional superstitions about concepts, and by ignorance of what is after all the fundamental ground of belief in energy, in causation, and in all physical reality, namely the immediate experience of activity and of enduring capacity to act enjoyed by each of us.

¶ 10. WHITEHEAD. Dr A. N. Whitehead is more thoroughly psychological. In his latest volume *Nature and Life*,[1] he writes: "My aim in these lectures is briefly to point out how both Newton's contribution and Hume's contribution are, each in their way, gravely defective. They are right as far as they go. But they omit those aspects of the universe as experienced, and of our modes of experiencing, which jointly lead to the more penetrating ways of understanding". These defects continue in modern thinking and "the result is to reduce modern physics to a sort of mystic chant over an unintelligible universe". Surely a just characterisation!

What then is wrong with modern physics? It abstracts and takes its abstractions too seriously. "The notion of the self-contained particle of matter, self-sufficient within its local habitation, is an abstraction. Now an abstraction is nothing else than the omission of part of the truth. The abstraction is well-founded when the conclusions drawn from it are not vitiated by the omitted truth". And the most vitiating part of the process of abstraction is the

[1] Cambridge, 1934.

omission of that aspect of experience which is the foundation of our understanding of activity. "My quarrel with modern epistemology concerns its exclusive stress upon sense-perception for the provision of data respecting Nature. Sense-perception does not provide the data in terms of which we interpret it. . . . Sense-perception, for all its practical importance, is very superficial in its disclosure of the nature of things". That is to say, modern epistemology and physics base themselves on an inadequate and misleading psychology.

In Whitehead's view: "Nature is a theatre for the inter-relations of activities. . . . The fundamental concepts are activity and process". And: "There are no essentially self-contained activities within limited regions. . . . Any local agitation shakes the whole universe". Thus: "The fashionable notion that the new physics has reduced all physical laws to the statement of geometrical relations is quite ridiculous. It has done the opposite. . . . It has thus swept away space and matter, and has substituted the study of the internal relations within a complex state of activity. . . . For the modern view, process, activity and change are the matter of fact". But sense-perception does not of itself disclose activity: "The truth is that our sense-perceptions are extraordinarily vague and confused modes of experience . . . sense-perception omits any discrimination of the fundamental activities within Nature. . . . In fact, science conceived as resting on mere sense-perception, with no other source of observation, is bankrupt. . . . The reason for this blindness of physical

science lies in the fact that such science only deals with half the evidence provided by human experience".

¶ 11. TOTAL IMMEDIATE EXPERIENCE. What then is the other neglected half of the evidence of experience? Clearly it is the evidence on which I have insisted above, the evidence afforded by our immediate experience of activity and by our own experience of ourselves as enduring centres of activity. "We are *directly* conscious of our purposes as directive of our actions". But: "Scientific reasoning is completely dominated by the presupposition that mental functionings are not properly part of Nature"; and, one may add, by the presupposition that all study and knowledge of them is otiose, that, in so far as psychological reflection is necessary to the scientist, he needs nothing more than the naïve and utterly confused psychology embedded in common speech.[1] "The weakness of the epistemology of the eighteenth and nineteenth centuries was that it based itself purely upon a narrow formulation of sense-perception. Also, among the various modes of sensation, visual experience was picked out as the typical example. The result was to exclude all the really fundamental factors constituting our experience".

That is to say (though Whitehead, sharing the common reluctance to acknowledge any indebtedness of philosophy, or of science, to psychology, does not say it), physical

[1] Dr. Whitehead is a notable exception. I have many times observed with pleasure my *Outline of Psychology* lying upon his desk.

science has, throughout its development, been perverted by its hasty and false psychological assumptions, and can be set right only by bringing to its aid a less inadequate and less misleading psychology.

¶ 12. SELF ACTIVITY AS CLUE. As Whitehead points out: "Descartes' 'Cogito, ergo sum' is wrongly translated, 'I *think*, therefore I am'. It is never bare thought or bare existence that we are aware of". As I have insisted,[1] the true statement is: I am active and causally efficacious, therefore I am. And other beings *are* in so far as they disclose to me their causal activity.

Whitehead's final word is that the key notion for the construction of cosmology "is that the energetic activity considered in physics is the emotional intensity entertained in life". Or, as I would rather put it, the key notion must be that causal activity is fundamental for physics as for psychology; and it must be frankly acknowledged that the activity recognised in physics by the use of such terms as power, force, energy, stress, work, is and can only be anthropomorphic, is conceived in the light of each man's immediate awareness of his own causal activity and his sympathetic intuition of similar activities enjoyed by his fellow men and by other living beings; that if such experience be denied or ignored (as by Hume and by almost all modern authors, psychologists as well as physicists) science can achieve nothing more than a descriptive phenomenology.

[1] In my *Outline of Psychology*.

CHAPTER XI

SOME OTHER PROBLEMS OF THE FRONTIER TOWARD PHYSICS

I have indicated in the foregoing pages how physics needs the aid of psychology no less than psychology the aid of physics, in relation to the problems of space, time and causation, or energy and force. I now pass on to consider briefly a few indications of the more general defects of physical science due to its neglect or misuse of psychology.

¶ 1. THINKING AND THINGS THOUGHT. The beginning and enduring condition of all clarity of thinking in science is to observe constantly the distinction between objects thought of and our thinking of them. Physicists, aided and abetted by philosophers (many of whom seem to regard it as their prime function to obscure this distinction), frequently use language which blurs and confuses this distinction. Especially is this done by the use of that very slippery and dangerous word 'concept' (and also 'idea'). Many physicists in the course of their discussions make statements of which it is impossible for the reader to say whether they are meant to be true of 'concepts' or of physical reality, for example, of matter or of the 'concept' of matter.

It is clear that most of them have never asked themselves what they mean by a 'concept', and that, if they were to

attempt to define the word, they would make as great a hash of it as do most of the logicians.[1]

¶ 2. TRUTH APART FROM SENSORY PERCEPTION. Closely allied with this is the modern tendency to deny all meaning to propositions which cannot be verified by direct perception. Thus it is now common form to say that the assertion, and even the mere raising of the question, of absolute position, absolute motion, absolute rest, absolute simultaneity, etc. is meaningless. It would be equally untrue to say that it is meaningless to speak of the reverse face of the moon, or of the central parts of the sun.

The most sensational error due to this tendency is the common deduction from the principle of indeterminacy. Heisenberg points out that it is impossible for us to ascertain precisely the velocity of an electron and, at the same time, its position. From which it follows that, *for aught we can know* from observation of the moving electron, its motion *may be* indeterminate; which conclusion a host of physicists at once, without logical ground, convert into the proposition that its movement *is* indeterminate; confusing the mental fact with the physical possibility.

¶ 3. STATISTICAL PROBABILITY VS. CAUSATION. A second almost equally notable instance of the confusion of the physical with the mental, of physical reality with our

[1] The history of the word 'concept' is a story of confused thinking, perverted by traditional misuse of language. *Cf.* my article *The Confusion of the Concept*, in *Journal of Philosophical Studies*, 1928.

thinking about it, is the setting up a sphere of statistical probability over against a sphere of causation, as though these were mutually exclusive in the physical sphere; whereas what are mutually exclusive are the mental facts, certainty and exactness of prediction on the one hand, ignorance of the future on the other.

¶. 4. CONCLUDING FROM ABSTRACTIONS. Closely allied again with the tendency to confuse physical reality with our thinking about it, is the practice of isolating some imagined physical system in a purely mental world, deducing conclusions from this impossible and purely imaginary experiment, and applying them to the real world. Of this a notable example is the common refutation of Newton's argument for the absoluteness or reality of rotatory motion from the centrifugal tendency shown, *e.g.*, by the water in a rotating bucket. Ah! says the modern physicist, determined to have everything relative only, but we cannot know whether it is the bucket that rotates, or the universe which rotates about a fixed bucket. It never seems to occur to him that two buckets might be rotated in opposite directions at the same time.[1]

The common failure to hold fast to the distinction between the object and the thinking of it tends to result in such fictionism as Needham's and in such subjectivism as

[1] He also overlooks the fact that in assuming the possibility that the bucket may be at rest while the stellar universe rotates about it, he ascribes to the stars a rate of motion very much greater than that of light, which, as he tells us, on other pages, is an impossibility.

that of Jeans, when he tells us that "the universe can best be pictured . . . as consisting of pure thought"; or that of Dingle, when he writes: "The universe of astronomy is a creation of the astronomer's mind".

¶ 5. VALUES IN SCIENCE. Finally, the physicist should be aware of the nature of what are called 'values'; that is to say, he should have some understanding of the psychology of valuation. For, though it may be a valid ideal that the physicist should exclude all valuation from his thinking, it remains forever impossible for the human mind (as we know it) to achieve such ideal thinking. In practice the physicist is swayed by his valuations; and he can allow for them, discount them, render them relatively harmless as the grounds of bias and prejudice, only through becoming explicitly aware of them and to some extent understanding their nature, influence and origin.

Valuations, except the most crude (which are founded directly in instinct), are founded in our sentiments, sentiments of love and hate, of liking and disliking, of admiration, awe, reverence, horror and loathing; complex mental growths peculiar to each individual, begotten of innate constitution by circumstance. It is idle for the physicist, or even the mathematician, to pretend that he is pure intellect, undisturbed by sentiment. If he had no sentiments of love for truth, or knowledge, or discovery, or adventure, or humanity, he would never be moved to exercise, in arduous thinking and experiment, such intellectual potentiality as he possesses. And the sentiments which supply

the motive powers of the efforts of the man of science inevitably determine in large measure the selection of the properties and qualities that he seeks and finds in Nature; and determine also the emphasis and value he attaches to each. Each physicist acquires, then, he knows not how, an array of sentiments peculiar to himself (of the existence and influence of which upon his thinking he remains for the most part entirely ignorant); and his work, the direction of his activity, the emphases and selections and valuations it reveals, are expressions of these obscurely working factors. One values most highly *predictability*, another *picturableness*, a third *intelligibility*, a fourth *permanence*, a fifth *harmony* or *order* or *system*; a sixth, like most metaphysicians, attaches the highest value to *unity*, another to *simplicity*, *coherence*, or *finality*, yet another to *measureableness*, or *countableness*, and not a few now-a-days, it would seem, to *paradoxicality*.

In short, physical research is not in any case the work of pure intellect, operating alike in all men, detached from the rest of their natures; rather it is in every case a mental activity in which the whole man is involved, with all the peculiarities of his unique personality; and the problems he attacks, the goals he seeks, the satisfactions he attains, the conclusions he reaches, are functions not only of the nature of the physical world but also of the nature of his own personality.

¶ 6. NEED OF SOUND PSYCHOLOGY FOR PHYSICS. If modern physics is "a sort of mystic chant over an unintelligible

universe" (Whitehead); if "there is something radically wrong with the present fundamental conceptions of physics" (Eddington), may it not be that the defect lies largely in its inadequate psychology?

As a last comment on this great topic here touched on so slightly, I would insist that the psychological discussions and assumptions of the physicists are not, as the lay reader may be inclined to suppose, merely ornamental touches added to their serious discussions in order to give them a philosophical air, but in reality otiose and of no influence on their procedures and conclusions. Let me enforce this by citing one or two striking instances.

¶ 7. RELIANCE ON BAD PSYCHOLOGY. I have to confess that I am unable to understand the theory of relativity in any but a very superficial manner; but I venture to point out that, according to Prof. E. Freundlich,[1] one of the leading expositors of Prof. Einstein's theories, two postulates are "the mainspring of Einstein's method of investigation"; namely, first, the postulate of *continuity*; secondly, that of *perceptibility*. The former denies action at a distance and demands that physics shall assume "continuity in the transmission of force, action 'by contact' in contradistinction to action 'at a distance' ". The second postulate is to the effect that "in the formulation of physical laws, only those things were to be regarded as being in causal connection which were capable of being actually observed", or

[1] *Einstein's Theory of Gravitation*; London, 1924.

that it is legitimate to infer "causal relationship between only such things as lie within the realm of observation".

These two closely allied postulates require that the ether be rejected as a fiction; and incidentally they imply the denial of all causal efficacy to mental activity. They would seem in fact to commit us to a return to the old mechanical physics, of which they, implicitly or explicitly, have long been the main props. Further they would forbid us to believe in telepathy, the evidence for which is now overwhelmingly strong[1]; and what, perhaps, is of more consequence to the physicist, they would, if taken seriously, make the conception of energy illegitimate. For, as we have seen, energy is not directly perceived; it is inferred from facts of sense-perception in the light of analogy with our immediate experience of our own activity; it is an hypothesis formed to help us "to understand those activities of Nature by reason of which the transitions of sense-perception occur" (Whitehead).

What then are the grounds and the justification for the setting up of these two postulates, which, we are told, "will probably not encounter any opposition in the matter of principle on the part of scientists? For both postulates are of an *inherent* nature, *i.e.*, contained in the very nature of the problem". What Prof. Freundlich may mean by the last obscure sentence I cannot divine. But he tells us further that both postulates "originate from the same

[1] And Prof. Einstein himself has expressed a friendly interest in telepathy. *Cf.* his foreword to the German edition of Upton Sinclair's *Mental Radio*.

instinct in the search for knowledge": and this alleged origin in an instinct "really gives the law of causality the true character of an empirical law, *i.e.*, one of actual experience".

This is a very typical procedure: the physicist formulates some fundamental hypothesis or principle, names it a postulate, and then calls upon us to accept it on the ground that it proceeds from some *instinct*. And this is called epistemology. It is, of course, merely bad psychology and bad logic. Bad psychology: for such easy-going *ad hoc* postulation of instincts to support assumptions and prejudices is an old and vicious trick played only too frequently in all the sciences. Bad logic: because, even if it were possible to show good ground for the assumption of the alleged instinct, or actually to prove its reality and its influence on our thinking, that would not by any means justify the physical postulates which are alleged to originate from it.

These two postulates are surely very similar to Lord Kelvin's postulate that any hypothesis is acceptable only if it is possible to illustrate it with a mechanical model; and the latter might equally well claim to originate in an instinct, whether a 'scientific instinct' or one of less august status.

CHAPTER XII

THE FRONTIER BETWEEN HISTORY AND PSYCHOLOGY

¶ 1. PSYCHOLOGY AND BIOLOGICAL SCIENCE. Between the physical sciences and the human sciences proper, the sciences of mind or spirit (*die Geisteswissenschaften*), stand, in an ambiguous position, the biological sciences. In the frontier regions between psychology and these biological sciences (especially physiology and the science of biological evolution) are many problems of the greatest importance; most of which are parts or aspects of the great issue between mechanism and vitalism.[1] They are so difficult, so controversial, and, for all profitable discussion, presuppose so much technical knowledge, that I shall not attempt to touch upon them in these pages. I pass on to the sciences of mind, observing merely that the answers still to be found to the problems of these frontier regions thus passed by without examination may be of the utmost importance in their bearing upon the problems of the regions now to be briefly considered.

[1] I use the word 'vitalism' in the broad sense, namely, to cover all varieties of biology that are not mechanistic. It is the fashion among those who repudiate the mechanistic biology to disclaim, equally fastidiously, the title of vitalist. But I know of no way in which vitalism can be defined other than as the comprehensive name for all non-mechanistic biology or biologies. The imputation that the vitalist pretends to solve all problems by the utterance of the magic words 'vital force' is absurd.

¶ 2. SCIENCES OF MIND. All the human sciences, the sciences concerned with man's activities and achievements, archaeology, social anthropology, comparative religion, mythology, comparative art, linguistics, jurisprudence, ethics, politics, economics, sociology, and the like, encounter at every turn problems which belong to the province of psychology, or lie in the frontier regions between them and psychology.

¶ 3. PSYCHOLOGICAL PROBLEMS. Of problems of the former class I say nothing here beyond insisting that no one of these sciences can, even with the best intentions, avoid using many psychological terms; can shut its eyes completely to the psychological problems that loom on every hand; can, if it endeavours to rise above the strictly descriptive stage, avoid seeking psychological explanations, forming psychological hypotheses. For example—What were the motives which in so many peoples have prompted and sustained them in the construction of vast pyramids, temples, statues, monoliths, works involving immense labour and cooperative effort on the part of great numbers of men? Did fear create the gods? What is the nature of 'numinous' experience? How is it founded in man's constitution? What is its relation to other modes of experience? How were primitive societies formed, and how held together, how developed into more complex systems? What is the nature of political power, of kingship, of communal responsibility, of subordination, of patriotism?

Until very recent years, even such purely psychological

questions as these (and there are thousands of them pressing for answers) were debated purely in terms of the popular psychology of common speech. A round dozen of vague popular terms, such as emotion, instinct, ideas, fear, desire, spirit of freedom, sense of beauty, of responsibility, of order, of this, that and the other, these composed the whole of the armamentarium with which the social sciences approached these subtle and profound psychological problems.

¶ 4. FRONTIER PROBLEMS. From these more purely psychological problems, the problems of the second class, those of the frontier, are not sharply divided. Yet a broad distinction may be observed. Those of the former class are such as may be solved by the application of established principles and of sound psychological reasoning to the data provided by the several sciences. Those of the latter class require the formulation of psychological hypotheses, conjectural explanations, which may serve as guides to the search for and selection of further data in the provinces concerned; a search which may be experimental, but more commonly in the human sciences is documentary; an exploration of literature, of myths, customs, beliefs, institutions, material structures, or other works created by the activities of men.

¶ 5. TWO GROUPS OF SCIENCES OF MIND. The frontier regions are as numerous as the human sciences. Since there is much overlapping of these sciences, their boun-

daries being largely the products of convenience, convention, and what may fairly be called historical accident or chance, there is corresponding overlapping and indefiniteness of the frontier regions. It is impossible to touch on all of them in this small book. I propose accordingly to select illustrations from each of the two great divisions of the human sciences. The two divisions are, on the one hand, the human sciences of fact, on the other the human sciences which inevitably deal with values. This distinction is not generally observed; and it is not by any means an absolute distinction of kind; it is rather one of less or more direct concern with values. Consequently, this grouping of the sciences of mind into two large divisions requires a few words of explanation.

In the introductory chapter, I have adopted and defended the practice of recognising concern with valuation as the distinctive mark of philosophy, the mark that distinguishes philosophy from science. How, then, the reader may ask, can we, consistently with the observance of this distinction, properly speak of sciences concerned with values? The answer is that, while it is the function of philosophy to evaluate, to refine, correct, and extend valid valuations, to systematise them, to work out a consistent and harmonious hierarchy of values, and thus to establish valid standards of value in all spheres of human activity, there remains for science the task of throwing light upon the processes through which we arrive at valuations and standards of value. That is to say, science, leaving to philosophy the task of enquiring into the validity of valuations, and of

refining and harmonising accepted values, is concerned with the nature of the valuing processes, the processes through which the accepted values have been established.

¶ 6. VALUING, A MENTAL PROCESS. It is obvious that these processes of establishing values are mental activities, that all such processes go on in the minds of individual human beings; that, therefore, they can and must be dealt with *primarily* in terms of the science of the human mind considered in abstraction from its social setting. A Robinson Crusoe, a human being growing up in isolation from all others, might and would achieve a certain number of crude valuations; he would learn to like or to love certain objects, his cave, his spear, his dog; and to dislike or hate other objects, the beast of prey, the destructive storm, the vermin which steal or spoil his crop. But in all human beings leading a social life the valuing processes are very largely shaped by the influence of the social group, which carries, as the most important part of its culture, a system of traditional values. Hence the psychology of valuation is for the most part social psychology, and is closely bound up with the various social sciences.

¶ 7. SCIENCE AND PHILOSOPHY OF VALUE. In actual practice these social sciences most concerned with the valuing processes, with the social psychology of valuation, are intimately mixed up with the properly philosophical task of evaluation. Such disciplines as ethics and politics (as commonly treated) are intimate blends of

science and philosophy; and it is for that reason we find them spoken of sometimes as science (the science of ethics or of politics) and sometimes as philosophy (ethical and political philosophy). Such mingling has been inevitable in the past; it will perhaps continue to be the rule; and, no doubt, some advantages accrue from it. Yet, where precision of thinking is desired, we do well to observe the distinction, to keep separate our scientific enquiry into fact, into what is, from examination of the problem: What ought to be? What is most to be desired and striven after?

In the province of sociology there has been considerable debate on this question of late years, between those who would strictly ban from sociology all attempts at valuation or revaluation, in order to build up a strictly scientific discipline, and, on the other hand, those who feel that this would dehumanise the science, and, by depriving it of its immediate bearing on practice, would perhaps sterilise it; who therefore defend the traditional procedure which constantly keeps an eye upon the normative problems and mingles philosophical discussion (*i.e.*, discussion of questions of validity and standards and norms and of problems of practice) with scientific investigation.

¶ 8. NORMATIVE AND HISTORICAL SCIENCES. There is, then, a group of the sciences of mind which is much concerned with values; of this group, ethics, politics, economics and aesthetics are the leading members. And there is the

group of those which have but little direct concern with values; of this group, history, archaeology, and anthropology (as commonly recognised in our academies) are the leading members.

In this book it is possible only to illustrate the frontier problems of these two groups of the human sciences by choosing for brief discussion one or two problems of central interest from each group.

¶ 9. PROGRESS AS A FRONTIER PROBLEM. Let us choose from the one group of sciences, the historical group, a frontier problem common to all of them, one in which they all are interested, one on which all may throw light and one the solution of which would greatly advance all of them, namely, the problem of progress. Now 'progress' is an evaluative word, it implies improvement, change from the less good to the better. What constitutes progress and whether mankind or certain divisions of mankind, certain tribes, races or nations, have truly progressed, these are questions for philosophy. But science, accepting the common opinion that, on the whole, the increase of complexity of social life which we call the advance of civilisation is progress, asks: 'What is the essence of such progress and how has it been brought about?' And this, I say, is one of the great problems of the frontier region between psychology and these historical sciences.

Historians are not agreed as to the aims and methods of 'history' in the academic sense, as we see from the frequent appearance of books and articles bearing some such title

as: 'What is History?' Beside those who regard the writing of history as an art and nothing more, there are those who say that history should confine itself to achieving and rendering in words accurate descriptions of past events, selecting those that seem of most general interest or importance. And here clearly we come at once upon an evaluative problem: 'What is our criterion of historical interest or importance?'

The inevitable raising of this question shows that this conception of the function of history as merely description is inadequate. For the answer must take some such form as that the more important events are those which we can in some sense understand, interpret or explain, which, therefore, afford us some guidance in considering our contemporary political and social problems. Historical description however detailed and accurate can do this only if it reveals something in the nature of historical laws or tendencies; if, that is to say, it *explains;* if it displays particular events as instances and illustrations of the working of general principles. And of all such explanatory principles the one of most general interest, if we could formulate and establish it, would be one which explains why progress occurs; why, while persistence without appreciable change seems to be the general rule, some groups of men, some societies, have manifested through long periods many changes and especially changes of the kind commonly regarded as progressive.

¶ 10. MECHANISTIC HISTORY. There is much similarity

between the present position in the historical and that in the physical sciences. In both it is usual to speak of philosophical treatment either with approval or deprecatingly; and in both cases what is commonly meant is the introduction of psychological considerations. It was not unnatural that the physical sciences should have been for a time dominated by the materialistic and mechanistic ideal. And so great was the prestige of the physical sciences throughout the Nineteenth Century that not only the biological but also the historical sciences tended to accept them as their model and aspired to realise the same ideal. Karl Marx was not the only materialistic historian. Indeed he was not strictly mechanistic. His famous economic determinism, though it was influenced by the static theories of Hegel, sought in fact to be dynamic and explanatory; the phrase 'economic determinism' meant for him nothing more than that economic factors play a predominant role in shaping the activities of men and societies.[1]

It would be easy to point to many historians who, in the endeavour to be scientific, have been more thoroughly mechanistic than Marx. Perhaps the brothers Henry and Brooks Adams represent this tendency in its most thoroughgoing form, in their futile life-long efforts to find the key to the history of mankind in such physical principles as the conservation or the degradation of energy.

Some historians have recognised that history should

[1] As Prof Seligman so clearly shows in his *The Economic Interpretation of History*; New York, 1908.

concern itself with the mind of man; yet, for the most part, like T. H. Buckle, have treated men's minds as passive reflectors of the scenes amidst which they lived, moulded perhaps by the environment, but of little or no account as agents in shaping their own destiny. And the general acceptance of the Darwinian theory did but accentuate for a time this mechanistic tendency of the historians. So that Bagehot, when he wrote his brilliant little book on the psychology of history, actually named it *Physics and Politics*.

¶ 11. PSYCHOLOGICAL HISTORY. It was not until the end of the century that an influential historian, Carl Lamprecht, made an attempt to bring about a radical reform in this respect. To the question 'What is History?' he boldly answered: 'History is psychology'. He sketched a grandiose scheme[1] in which history is conceived as a special branch of psychology, the story of man's mental life. Unfortunately the psychology which he attempted thus to apply, was that of his colleague in the university of Leipzig, the very inadequate psychology of Wundt, which vacillated uncertainly between the mechanistic theory of man and a less sterile view.

Other historians have followed him in the recognition of the essentially psychological nature of the major historical problems, in urging that history, if it is to be a science, must be a psychological science. Two eminent

[1] Lamprecht; *What is History*; New York, 1905.

American historians have been leaders of the movement. Dr J. Harvey Robinson has shown the way in his *Mind in the Making*; and Dr C. A. Beard has criticised the prevalent mechanistic determinism and pleaded for a more philosophical treatment of history, clearly meaning a treatment which shall put the mental life of man and peoples in the forefront of historical discussion, as the agency of which institutions, customs, laws, religions, and all culture-elements are but the expressions and embodiments (*der objective Geist*).

British historians are not altogether blind to the need for such reform or development of the methods of history. Mr A. L. Rowse[1] writes: "The problem is deeper than that of the relation of history to literature; and the generalising principles that we are seeking may be found to be outside the peculiar sphere of either". He demands a dynamics of society, and an attempt "to understand and estimate the motive forces in history", also "the investigation of the springs of action in the individual, and of the motive forces at work in society; and not investigation only, but analysis and formulation. It is significant", he adds, "that the sciences in which the present has contributed most to the store of knowledge accumulated in the past, have been anthropology and psychology. There is a stage when it is more important to study the origins of a thing and the conditions of its development, than the thing in itself. Such is the stage that we have reached

[1] *On History, a Study of Present Tendencies*; London, 1927.

with regard to the life of man in society".[1] Which is to point to the psychological origins of the events and institutions described by historians.

"If the Seventeenth Century" writes Mr Rowse [and, we may surely add, the Eighteenth and Nineteenth] "achieved its results by confining itself to phenomena capable of being expressed 'in terms of number, weight, or measure' and considering 'only such causes as have visible foundations in nature', the line of progress for thought in the Twentieth Century is to extend these methods into the sphere of 'the mutable minds, opinions, appetites, and passions of particular men' ".

The same author even goes so far as to recognise the need of history for the psychology, not only of the individual, but also of the group, for collective psychology. "It is not necessary to suppose that the great majority of people are aware of the motives determining their corporate action; though when the mass of a nation enters upon a modern war, it probably does so out of some obscure realisation of a vague instinct of self-preservation". He points with approval to the social psychology of Graham Wallas and of Mr J. A. Hobson. "The general movement of man in society is the primary concern of history; and the historical province is

[1] This is a most apposite remark. There has been an immense amount of work devoted to the study of the products of man's mental activities; while the study of those activities, the source of all culture-elements, has languished in the background neglected, or touched on incidentally, often dogmatically, by scholars who have made no attempt to equip themselves for this most necessary task, fundamental to all the human sciences.

first and foremost that of men in the mass. Men as individuals may primarily be ruled by emotions of love and fear and rivalry; but as political beings their separate instincts of self-preservation must cohere into the general interest. This is the necessary condition of the existence of society". . . . "No sane theory of history involves a belief in impersonal forces extraneous to men; whatever forces are seen at work in history must act through and by men. But what the impersonal view achieves as an end, is to account for those elements which are common to all men's aims, and for their concentration and focus upon a certain direction".

In short, the historians who would make history a science by seeking to understand a 'natural hierarchy of the forces' which bring about change and development are beginning to see that the forces with which they are concerned are mental forces, the desires and the mental activities of men, and that, if we are ever to progress beyond such vague explanations as that a nation goes to war "out of some obscure realisation of a vague instinct of self-preservation", these require to be systematically studied.

¶ 12. HISTORY AND SOCIOLOGY. Now, when history thus aims to become scientific, it inevitably approximates to sociology. A recent article [1] states the position as follows:

[1] *Sociology as a Science*, by Christopher Dawson in *Science To-day*; London, 1934.

"History is, in fact, whether consciously or unconsciously, becoming the science of social development; not merely the science of the whole human culture-process in so far as it can be studied by documentary evidence. Thus the old opposition between science and history is being done away and history is being brought into increasingly intimate relations with the other social sciences and above all with sociology. History and sociology are, in fact, indispensable to one another.[1] History without sociology is 'literary' and unscientific, while sociology without history is apt to become mere abstract theorising.[2] Hitherto the greatest weakness of sociology has been its indifference to the facts of history . . . this is the inevitable result of the mutual distrust between history and sociology and the attempt of each of them to assert its own independence and self-sufficiency. In reality sociology and history are two complementary parts of a single science, the science of social life. They differ, not in their subject matter, but in their method, one attempting a general systematic analysis of the social process, while the other gives a genetic description of the same process in detail. In other words, sociology deals with the structure of society, and history with its evolution".

But sociology, like history, has suffered from the mechanistic disease:

"From the beginning sociology has been haunted by the dream of explaining social phenomena by the mathematical and quantitative methods of the physical sciences and thus

[1] As urged by Prof. C. A. Ellwood in his recent essay, *Methods in Sociology*; Durham, N.C., 1934.

[2] The historian who inclines to regard sociology as 'bunk', should remember Mr Henry Ford's famous pronouncement upon history.

creating a science of society which will be completely mechanistic and determinist. The path of sociology is strewn with the corpses of defunct systems of 'social physics', 'social energetics' and 'social mechanics'. . . . Such extravagances explain the distrust shown towards sociology by the historians, for their experience of the complex reality of the social process makes them naturally hostile to the crude simplicity of pseudo-scientific generalisations. Yet on the other hand, it is equally impossible to understand the life of man and society without the help of the natural sciences. . . . History by itself is not enough, for it is impossible to understand a society or a culture in purely historical terms. . . . The natural scientist has a completely homogeneous material in the material phenomena that he investigates; so also has the philosopher in the region of ideas; but the sociologist has to deal impartially with material and spiritual factors, with things and ideas, with moral and economic values, with all the multifarious experience of the two-sided nature of man. . . . All 'simple' explanations are unsatisfactory. . . . It is impossible either to make society its own cause or to deduce social phenomena exclusively from material or spiritual ones. . . . Material development, social organisation and spiritual culture all help to condition social phenomena, and we cannot explain the social process by one of them alone, and still less explain one of the three as the cause and origin of the other two. . . . We must recognise at once the determination of natural conditions and the freedom of spiritual forces, and must show how the social process embraces both these factors in a vital union like that of the human organism".

Thus Mr Dawson (although he carefully eschews the word 'psychology', uses the word 'spiritual' whenever he

has occasion to refer to mental activities, and invokes for sociology the aid of philosophy [1] and theology rather than of psychology) clearly defines the need of history and of sociology for each other and for a common psychological basis. And it is to the sociological historians or historically inclined sociologists that we must look for contributions towards the problem of progress. Suggestions or hypotheses of any value or interest can come only from those who, repudiating the mechanistic dogma, recognise the causal efficacy in the natural world of man's mental activities, of his purposive and intelligent strivings.

¶ 13. FRONTIER PROBLEM OF PROGRESS. None of the thinkers who touched on the problem of progress in the period before the establishment of the theory of organic evolution (neither Hegel, nor Herder, nor Lotze) could make any substantial contribution towards the solution of it. For in that period the essential conditions of the problem could not be defined.

The problem is a major frontier problem; in the attack on it, not only psychology, history and sociology must cooperate, but also biology with all its methods of approach to the theory of evolution; genetics, palæontology, embryology, comparative morphology, and physiology (especially its very modern branch, endocrinology) must all be heard.

[1] We have too many examples of what 'philosophy' without psychology achieves in this sphere. The works of Spengler and Pareto are the latest in that genre. Is it too much to hope that they may be also the last?

Thus the problem is the great meeting ground of many sciences. And it is one not only of the deepest theoretical interest, but also of the greatest practical importance. For the fate of our own race and nation, of all our civilisation, perhaps of all mankind, hangs upon our success in this combined attack.

What shall it profit us to penetrate the mysteries of the atom and the electron, to measure in thousands of light-years the paths of the great nebulæ, to invent the most marvellous machines, to set free and control unlimited reserves of energy, if all such physical discoveries cannot save us and our civilisation from the abyss, can but hasten the repetition of the old story, can but precipitate the downfall and decay which hitherto have followed swiftly upon every partial success of human effort to lift some part of the human race above the 'darkling plain, filled with confused alarms of struggle and flight, where ignorant armies clash by night'?

I will not pretend to sketch all the more promising attempts to throw light on this great problem. I will rather illustrate its many-sided fascination by briefly stating and examining in the next chapter what seems to me the most brilliant, as it is the most recent, of all such speculations.

CHAPTER XIII

THE PROBLEM OF HUMAN PROGRESS

Mr Gerald Heard's *Ascent of Humanity*[1] answers to the prescriptions we have laid down in the foregoing chapter as essential for profitable approach to the problem of progress. It is a work of sociological speculation written with a great command and skilful use of historical material, and with full realisation that the problem is essentially a psychological problem, that progress means, and can only mean, increasing effectiveness of man's mental activities in the struggle for the attainment of his goals.

¶ 1. OLDER VIEWS. Before attempting to give a very concise statement of Mr. Heard's theory, what may be called the orthodox view of science may be indicated as the background from which it emerges as a novelty.

In the middle of the last century when the theory of organic evolution became generally accepted, there was much speculation on the bearing of the theory on the history and destiny of mankind. All earlier speculation on this topic had gone under the name of philosophy of history. It was philosophy only in the vague sense that it certainly was not science and that it attempted to be synoptic.

¶ 2. LAMARCKIAN PRINCIPLE. Herbert Spencer, who had

[1] London, 1929.

planned a comprehensive theory of evolution before the appearance of Darwin's *Origin of Species*, brought man and human society into his scheme. He held that the civilised part of mankind differed greatly from their primitive ancestors not only in culture but also in constitution, that throughout the period of the development of civilisation there had been a continued progressive evolution of human nature in those branches of the human race which advanced in culture; the progress in culture was, in his view, in the main a consequence and expression of progress in respect of innate mental constitution.

This scheme of human evolution was naturally correlated with the acceptance of the Lamarckian theory, the theory that the improvements of facilities of various kinds achieved by the efforts of the members of each generation are transmitted to their progeny. For example, facility in the use of language is one of the most essential superiorities of man to the higher apes, and it implies undoubtedly the addition to the inborn constitution of the ape-like ancestor of man some highly complex innate basis of speech. According to Spencer's theory, this addition is regarded as having been achieved largely, if not wholly, through the efforts of many generations of such ancestors and of the primitive men into which they were evolving, efforts at vocal expression and communication which gradually improved the facility for such vocal expression: small improvements transmitted from generation to generation built up by minute steps the complex innate basis of speech, of all language and, therefore, of all the higher forms of mental

activity (for, without language, mental activity could not rise above the concrete level, could not achieve the abstraction of qualities and relations essential to all reasoning save the most rudimentary).

Spencer, who accepted, and indeed had independently formulated, Darwin's great principle of natural selection (or survival of the fittest) as an important factor in organic evolution, regarded it as supplementary to the Lamarckian factor, as tending to preserve and give predominance to those individuals and groups who, by reason of their own efforts and those of their ancestors, had achieved a superior facility in this most useful of all social practices. In this he agreed with Darwin; the difference between them being that, while for Darwin natural selection was the main factor and the Lamarckian factor subsidiary, for Spencer the relative importance of the two factors was the reverse.

¶ 3. MECHANISTIC BIOLOGY. Then came the period of the predominance of Neo-Darwinism. August Weissmann made a vigorous assault upon the Lamarckian principle; and since this principle could not be reconciled with the theory of strict mechanism (which at that time was a dominant dogma in the scientific world) he was followed by the great majority of the biologists. Neo-Darwinians had no difficulty in showing that the Lamarckian principle had not been shown to be valid in any one instance, and that every supposed instance might with some plausibility be regarded as in reality an instance of evolution through natural selection alone. At the same time anthropologists

and sociologists were learning that 'our contemporary ancestors', existing men of lowly cultures, were not so different from our highly civilised selves as Spencer had supposed; that, when brought up under the conditions of civilised life and the influences of education, many of them could assimilate the virtues and elegances of our culture as well as its vices.

¶ 4. OLD 'ORTHODOX' VIEW. These two trends combined to establish the view which is still 'orthodox'. It was formulated by the dean of American anthropologists, Franz Boas, in his *Mind of Primitive Man*,[1] to the effect that there are no significant differences in mental constitution between ourselves and other races however primitive, that the superiorities of one group over another are wholly and solely in culture and not at all in constitution. Boas was an engineer by training, and the formula was natural to an engineer and highly acceptable to all the mechanistically minded. For, to the mechanical psychology predominant at that date, man's inborn mental constitution consisted of nothing more than a considerable number of mechanical reflexes; and the only possible native superiority of one man to another was the possession of a larger number of nerve-cells ready to be worked up into new reflexes.

There was a second ground for the rapid acceptance of this view; namely, it was consistent with the great humanitarian formula that 'all men are created equal', and was therefore acceptable to democratic sentiment. And a third and

[1] New York, 1911.

more scientific argument tended to the same conclusion. In the prehistoric and pre-human ages, mankind's ancestors, it seemed, might well have been subjected to conditions of life so severe as to maintain a stringent natural selection and, hence, a progressive Neo-Darwinian evolution. Whereas, civilisation seems everywhere and inevitably to mitigate, in proportion to its efficiency, the play of natural selection, and thus to bring to a stop all evolution by the Neo-Darwinian principle of pure selection; indeed it would seem likely that, in its more advanced stages, civilisation must have reversed the evolutionary trend and have favoured the survival of the less fit, of the lower types, rather than of the higher.

This generally accepted negative conclusion (that the human race ceased to evolve at some unknown date in its remote past) involved the corollary that all progress since that date has been progress in culture alone. The problem of human progress thus became the problem of the progress of culture: Why has this or that community or race progressed in culture, while others, equally well endowed, have stood still or gone backward? To the problem thus stated the answer could be given only in terms of environment alone. And along this line the search has been concentrated.

¶. 5. RESETTING OF PROBLEM. Of late years however there has been a resetting of the problem in less crude terms; and the whole great question is again open. First, the search along the cultural line has failed to find any satisfactory

answer. Secondly, men's minds have been freed from the mechanistic creed. Thirdly, it has been realised that Neo-Darwinism is impossible as an exclusive and all-sufficient theory of evolution. Fourthly, more careful review of the facts has thrown doubt on the proposition that all men are created equal and alike. Fifthly, psychology has revealed, more and more clearly, the richness of the native basis of the mind, and hence a wealth of possibilities of differences, of superiorities and inferiorities, between one man and another, one race and another, in respect of mental constitution.[1] An adequate review of all these grounds of the change of view now in progress would require a large treatise. The principal grounds can only be briefly indicated here. Those under the last two heads are perhaps of most weight.

¶ 6. NATURE AND NURTURE. The mechanical view of man necessarily emphasised the importance of environment, stressed nurture and belittled nature or native endowment; and a rough inspection by anyone lacking psychological insight revealed nothing incompatible with this opinion. Yet, as more careful comparative studies of various human stocks are made, it appears that in spite of much that all men have in common, great differences remain.

The best examples of men of the lower cultures have assimilated European culture in copious measure. Yet, where communities of such men have been given every opportunity to make such culture their own, they have

[1] *Cf.* my *Energies of Men*; London and New York, 1932.

shown indifference to it or positive aversion, or incapacity to sustain it. The well-bred Maori, one of the finest of all such types, may for a time live according to European standards; but the strain is too great, and he goes back with relief to the simple life of his people. In Haiti and Liberia we see communities of Negro stock failing to maintain any of the essentials of civilisation.[1] In America the Red men remain child-like wards of their white conquerors; and the 'coloured people' assimilate culture and maintain civilised standards in the proportion in which they have white blood.

¶ 7. RACIAL DIFFERENCES. Attempts to devise exact measurements of these differences do but touch their fringe; and it seems likely that such measurement must forever remain beyond our powers. Yet in so far as such measurements have been possible they tell the same story, that of deep-seated racial differences. The Cambridge Expedition to Torres Straits made the first serious attempt at such measurements; and, as a member of it, I was able to demonstrate certain large differences between ourselves and the oceanic negroes in respect of sensory endowment. If, then, there are wide differences in respect of this most ancient and fundamental part of our mental endowment, it would seem more likely than not that differences at least equally great should obtain in respect of the higher parts.

[1] A few years ago it was reported that in Liberia not a single wheeled vehicle was to be found. The wheel, one of the prime factors of civilisation, had gone out of use.

'Intelligence testing', so widely practised in America, shows consistently racial differences of level in respect of the functions tested.

More convincing in re-establishing the importance of native endowment, in proving that it shows through all individual acquisitions due to environment and education, and indeed does much to select and determine the environmental and educational influences that shall effectively operate, have been careful studies of twins, especially of 'identical twins' grown up apart under different conditions. They have abundantly vindicated Francis Galton's original argument pointing to the predominant role of 'nature' over against 'nurture'.

More specialised evidence of the same kind is afforded by the application of the methods of mental testing to great numbers of children, especially by the work of Terman and his colleagues on 'gifted children'. They confirm what every unbiassed and discerning schoolmaster, and indeed every *Menschen-kenner*, has long known, namely, that innate constitution can be only superficially modified by environmental influences, whether in physique, in temperament, in disposition, in temper or in intellectual capacities. Even that most universal and fundamental quality, retentiveness, shows its individual and inherent peculiarities.

¶ 8. ACTIVATION OF NATIVE ABILITIES. One series of facts has long tended to obscure the truth for less discerning observers. Namely, every native potentiality can

be actualised only when certain conditions are given. The child of potential high stature will remain stunted on an inadequate diet; the potential athlete will have a poorly developed muscular system, if it is not exercised; lack of iodine, or of other chemicals, normally supplied from outside or from inside the organism, may result in gross defects and distortions of development. But the most perfect environmental conditions cannot push the organism in any direction beyond the limits prescribed by its native constitution.

There remains, also, pointing in the same direction the supreme fact, the supreme problem of all evolution-theory, the immense gap between man and ape.[1] How was that gap crossed? This is the problem which, more clearly than any other, reveals the inadequacy of Neo-Darwinism. In view of this and allied problems, many authors have recently fallen back on theories of *ortho-genesis*. The word does little more than point to the need for a theory. It implies some driving and directing power or tendency, whether intrinsic or extrinsic to the organism and the species. Such is Bergson's *élan vital*, the *nisus* of Alexander, the God of Lloyd Morgan and other emergent evolutionists, the holistic tendency of Smuts, and other, if possible vaguer, conceptions of directive agency making for 'progress'.

¶ 9. INSTINCTIVE ENDOWMENT. Modern psychology, the

[1] Whether man's animal ancestor was, or was not, entitled to be called ape or ape-like, is, in spite of some authorities who make much of it, a question of minor importance.

psycho-analytic speciality no less than the more academic and comprehensive hormic psychology, is showing that the indispensable term *instinct*, or *instinctive endowment*, points to something far more subtle and profoundly influential than a congenital mechanical reflex or any bundle of such reflexes. The studies of Pavlov and his question-begging term 'conditioned reflex' have been widely used as a blind, a red-herring drawn across the path of progress. Of far more profound significance is C. G. Jung's doctrine of *the collective unconscious*, a term which comprehensively points to a native basis of the human mind far more influential, far more differentiated and specialised, than that postulated by most of the psychologists; a basis which determines not only primitive highly general modes of instinctive reaction, such as we share with the animals, but also more specialised modes of thinking and feeling, the archetypal modes, both those common to all the human race and those special to its various branches, specialised native capacities which determine the forms of our myths, our dreams, our arts, our politics, and our religions.

We may sum up by saying that all the Twentieth Century sciences of life are pointing us away from the rationalistic mechanistic theory of man, which Nietzsche called the Apollonian theory, and back to its age-long rival, the Dionysian theory.[1]

[1] *Cf.* my essay on this topic in *Religion and the Sciences of Life*; London, 1934.

CHAPTER XIV

HUMAN PROGRESS AS EVOLUTION

¶ 1. ORTHOGENETIC THEORY. The previous chapter has sketched in brief outline the background of developing thought on this profoundest of all the problems that confront the mind of man, the background on which Mr Gerald Heard projects his interesting speculation with regard to human progress. His theory belongs to the class of orthogenetic theories. In virtue of some factor not further specified, the race progresses in mental power, consciousness widens, sympathy deepens and becomes more comprehensive. And history is the record of this subtle process of evolution.

"History, in short, is the shadow cast by the changing and growing spirit of man. . . . History does not and cannot repeat itself, because all history is the shadow cast by the evolving spirit of man, and man does not repeat his growth but goes from his beginning to his end. As man is 'a transitional animal', a creation of crisis, passing at a speed no other animal in its evolution has ever attained, from complete and unquestioning dependence on his environment to complete power over and understanding of that environment, so, as he approaches the climax of that crisis, the moment when power passes into understanding, and understanding of the environment passes up into a realisation and understanding of his self as part of that environment, he must come to a moment when he sees that all advance must henceforth be in the mind, in himself. First, as an animal, his advance was infinitely

slow and hesitant. He came in as a piece of driftwood is floated from wave to wave and finally is thrown on the shore. Then as man, but still a creature of action not reflection, a creature that had always to do before it could know, he altered his environment, and only by doing so did he discover what his nature was and how it was in answer to its altering demands and because of its altering character that he had altered outer nature. It is clear that in such a process there must come a moment when men come awake to what they are doing and become self-consciously aware why they are doing it. It is clear that such a moment must be sudden and critical, and beside this revolution in consciousness all other revolutions are vague and partial things".[1]

Mr Heard writes further of "the deep main drift, the undercurrent of instinctive life, on which culture and civilisation . . . the way of life of that late comer and fast-goer, Modern man . . . is carried, as mysteriously and as involuntarily as the evolution of any other animal species to its unknown bourne". The author's intention is "behind the phenomenal convulsion (of the present time) to detect the profound psychological cause". He "believes that all the outward shocks we have experienced, wars, revolutions, disconcerting discoveries, violent changes in values and ideals, are only symptoms of a vast 'subterranean adjustment' below the ordinary consciousness of the human mind. He believes that there is one consistent theme behind the chaos of modern events. . . . That theme is the increasing consciousness of the human mind,

[1] G. Heard; *These Hurrying Years*; London, 1934.

increasing consciousness of a new revolutionary knowledge of what outer nature actually is, what the mind's own nature is, and of the profound, mysterious relationship between them".

¶ 2. GROWTH IN SELF-CONSCIOUSNESS. The foregoing citations are from Heard's recent book, in which he interprets our distressful present in terms of the theory he has developed in an earlier volume for the interpretation of history in general.[1] In the latter he makes the orthogenetic assumption, namely that (for reasons unknown) evolution of man's mind goes on, his powers enlarge, and he becomes more and more fully self-conscious. And the development of self-consciousness is, we must remember, the development of will, of volition, of self-direction towards ideal goals; or, rather, development of self-consciousness (both individual and collective) is a prime condition of that organisation of character which converts sporadic impulse into volition and sustained resolution.[2] Also man develops a fuller, more adequate collective consciousness; and this is a feature of the scheme on which much stress is laid. Although the nature and grounds of this group-consciousness remain in the author's view very vague, it is clear that it involves, in proportion to its evolution, a corresponding degree of sympathy and obligation of the individual to the group.

[1] G. Heard, *The Ascent of Humanity*; London, 1928.

[2] That is the thesis of my *Social Psychology* and of my *Group Mind*.

¶ 3. 'SPIRAL' EVOLUTION. It is a special feature of Heard's orthogenetic theory that development proceeds not in a straight line but in a spiral (a feature which makes the name a misnomer); a spiral which leads from successively higher levels of individual self-consciousness, to successively higher levels of collective consciousness. And the impulse to merge the individual in the group, to subordinate completely the lesser to the larger self, the group-self, becomes one of the master motives of human activity and the only one which can sustain a completely satisfying activity, therefore a necessary and ever more insistent condition of that universal goal, happiness.

¶ 4. THEORY AND FACT—THE RENASCENCE. I do not stress Heard's theory of the spiral course of human evolution. It is I think one of the more disputable features of his scheme. Let us rather consider one important historical event and see how a theory of continued evolution seems implied and required for its explanation. I choose the European movement known as the Renascence. The problem is: 'Why did there occur this outbreak of intellectual activity, of free and sceptical enquiry, after the long mediæval period of strictly limited orthodox belief and thinking, a period in which the most daring intellectual flight was merely to modify in some degree some accepted interpretation of some phrase of Aristotle?' The change was of supreme importance; its result was the modern period of our Western civilisation which has brought an increase of knowledge of Nature and of man's history

that has proceeded at a constantly accelerating pace and has wrought immense changes in every aspect of our lives, moral, intellectual and practical; until now we stand before the question: Can the human race assume control of its own destiny and assure for itself an indefinitely long future of welfare and, perhaps, of progress?

The epoch has been absolutely extraordinary; in fact unique. There have been other great civilisations. But all have been, relatively to ours in this modern period, static; they have risen slowly to a certain level of knowledge and morality and have then, slowly or rapidly, declined. The only event known to us as in the least comparable is the brief flowering of Athenian culture. But, though the achievements of architecture and sculpture reached a high level, free enquiry made only a few steps. It was confined to a very few individuals; it faltered and died away before it had accomplished any solid results, before it had discovered the way to knowledge, the scientific method.

¶ 5. PROGRESS OF RENASCENCE. This unique movement is sometimes called 'the revival of learning'. That designation implies the narrow schoolman's outlook. It might better be named 'the downfall of learning'. Other cultures have put their trust in 'learning', and have remained static. The scholars of China, of India, of the Mohammedan world have concentrated their efforts upon 'learning', poring over the texts of the wise men of the past. And to this day the devotion of so much effort to 'learning' remains an influence that gravely hampers the progress of

Asia. The bulk of the scholars of mediæval Europe did likewise in grammar schools and universities; and the consequence was conservation without progress.

In accordance with this designation, 'revival of learning', the movement has been commonly explained as the consequence of a renewed interest in the writings of the classical age of Greek and Roman culture. The explanation takes an effect for the cause. We wish to know why this renewed interest was manifested. The renewed interest is only a part, and a minor part, of the great change. Galileo, who, more than any other individual, was one of the creative agents of the movement, owed little to classical studies. No great hidden store of ancient books was unearthed. The works of the classical authors had been available in libraries throughout 'the dark ages'. And they had been studied; but such study did not provoke, did not directly produce, any advance of science.

¶ 6. PROGRESS IN MORALS. Again, the progress of modern Europe has not been in respect of science alone, nor of the many forms of increased control over Nature that have resulted from increase of knowledge. The progress has been also a progress of morals; a fact too often overlooked in our self-depreciatory age. Consider how the culture of Athens, confined to a free aristocracy, was based on a vast and cruel system of slavery, not only on domestic slaves but also on hordes of fellow Europeans toiling without light or hope, lashed and tortured till they expired worn out in the galleys and the silver mines.

¶ 7. OLD AND NEW MORALITY. Think of a Roman holiday in the Coliseum; of the terrible cruelties and injustices, crucifixions and other tortures that were everyday occurrences. Think then of the modern European attitude to slavery, even of the mildest forms, and of the history of the abolition of slavery in Europe and America. It is natural to regard the great moral advance, of which this modern loathing of slavery is but the most striking feature, as the work of the Christian religion. But it is clear that the teaching and nation-wide acceptance of Christianity does not directly produce such effects. No nation was ever more completely subject to the control of the Christian Church than the nation ruled by his most Christian Majesty, the Emperor of Spain, at the time when it applied the first fruits of modern knowledge to slaughter and destroy and, with utmost cruelty, reduce to slavery the ancient civilisations of America; the same nation maintained within its own borders and in the name of Christianity all the savage horrors of the inquisition.

Think also of the great missionary undertakings of modern times, with the many sustained efforts to bring the benefits of education, medicine, surgery and hygiene to vast populations which receive them grudgingly. It is true that much of this enterprise is the work of the Christian Churches. Yet Spain in her great imperial days converted multitudes of the heathen; but her instruments were the sword and the stake. We still wage murderous wars; but the Red Cross is a wholly modern institution.

Think again of the strictly modern concern for the welfare

of animals, of the laws which forbid cruelty to them; again a series of phenomena which seem to have no positive correlation with the effective sway of the Christian Churches, and have no parallel even among peoples whose religion has forbidden the taking of animal life.

Nor does the moral advance result merely from the greater freedom of communication between peoples that has resulted from the progress of science. Throughout the vast extent of the Roman Empire with its excellent system of roads, communication and transport were freer and more abundant than in mediæval Europe; men of many races were gathered in Rome and became familiarly known to one another; Africa was less remote than it later became and remained until the Nineteenth Century. Roman proconsuls ruled by cruelty and spoliation and devastation; but history records no Roman precedent to the indictment of Warren Hastings. The notion and the practice of trusteeship on behalf of simpler peoples is strictly modern. The alternatives for the conquered in all previous ages were ruthless tribute or ruthless extermination.

Much importance has been attached to improvement of the art of navigation and the consequent contacts of Europe with other continents. However the improvement was but slight. Phœnician traders had regularly sailed out of the Mediterranean and visited the coasts and islands of North Western Europe before the Roman Empire was founded; the Northmen had established themselves in Iceland, landed in America, and spread their conquests all round the coasts of Europe long before Columbus reached

the western isles. Chinese sailors and junks were as efficient in the centuries B.C. as they are now, probably at least as efficient as Columbus and his galleys. And if there was substantial improvement of the art of navigation about the time of the Renascence, that was but one of many similar improvements, one of the effects of some fundamental change rather than itself a primary cause of change.

¶ 8. THE CAUSES OF PROGRESS. The modern progress of our civilisation, both intellectual and moral, has been very real and very great. And we can point to no outward circumstance, no change of climate, no new revelation from on high, no new religion, no novel institution, no political invention, to which the progress can be attributed. There has been, doubtless, much subtle interplay of divers cooperating factors; the art of printing, the spread of literacy, parliamentary and democratic government, these have contributed; but none of these, nor all of them together are sufficient causes of the change; they are its effects rather than its causes.

And so we seem compelled to agree with Mr Heard in postulating, as the fundamental cause of modern progress, some step of progressive evolution in the mental constitution of men; a step in consequence of which men's minds reached out after new truth, no longer content to accept the traditional lore in which truth and error were indistinguishably blended, the error vastly predominating over scraps of true knowledge; no longer content with the old

traditional system of values, and the narrowly limited sympathies of their ancestors.

Are we then condemned to remain in total ignorance of the causation of this evolutionary change, in ignorance faintly disguised by such terms as 'orthogenetic evolution', as 'élan vital', 'emergent evolution', 'holism', 'nisus of change'? The words 'vital force' were 'mellow music' compared with these, and are no less and no more enlightening. For all of them merely indicate the postulation of some unknown agency, not further defined than as that which brings about evolution, or, perhaps, produces the adaptive mutations (not the pathological defects so much studied as mutations by the geneticists, mere failures or fallings away of essential factors) without which natural selection is powerless to advance the race. An attempt to provide a satisfactory answer will be made in the following chapter.

CHAPTER XV

THE FUNDAMENTAL CAUSE OF HUMAN PROGRESS

¶ 1. MENTAL ACTIVITY AS CAUSE. I hold that we are not condemned to remain in such ignorance, to invoke these mystic agencies, agencies with which we have no direct acquaintance, which we vaguely conceive *ad hoc* to fill a rôle which certainly is a rôle of vast importance. There is an agency with which we are acquainted; of which we all have immediate knowledge and experience. That agency is our own mental activity, our intelligent purposive striving to adapt ourselves more fully to the world, the world of our fellow creatures and our physical environment. And there is strong ground for believing that this familiar agency is of the same nature as the causally efficacious agent which manifests its achievements as the steps of organic evolution. Before we fly to agents postulated *ad hoc*, we should surely exploit for all it may be worth this familiar agency, of whose efficacy we have daily and hourly experience. It is possible that it may fill the bill.

This possibility has been grossly neglected by modern science, owing to the strong pervasive influence of the mechanistic prejudice. It has worked in two ways. First, as Whitehead says: "Scientific reasoning is completely dominated by the presupposition that mental functionings are not properly part of Nature". Hence biologists habitually exclude the mental functions from their purview; and

even the psychologists, for the most part, do not take them seriously as 'part of Nature'. Hence the persistent and futile endeavours to construct a theory of organic evolution in which mental activity has no place, no rôle.[1]

Secondly, when the living creature effects some new adaptation of structure and function, it is impossible to suggest any mechanical way in which the germs within it may be correspondingly modified, so that the adaptative modification may be passed on to the offspring. Hence, the obstinate denial by the majority of biologists of the Lamarckian factor in evolution, the 'transmission of acquired characters'.

¶ 2. TRANSMISSION OF ACQUIRED CHARACTERS. The Lamarckian question is in a most unsatisfactory condition. After a period of acute controversy in which Herbert Spencer and Samuel Butler (to mention only the leading British advocates) stoutly argued for the truth of the Lamarckian theory, fighting a losing battle, the fusion of Mendelian genetics with the Neo-Darwinian theory has closed the minds of the geneticists, has for them locked, bolted and barred the door; so that, even though an angel from heaven should reveal to them the truth, they would turn away untouched. On the other hand, psychologists, like Sigmund Freud and C. G. Jung, concerned to under-

[1] Charles Darwin, be it noted, made no such error. It remained for his disciples Huxley and Haeckel and Weissmann to give to modern biology its strictly mechanical cast.

stand the foundations of the mind, freely postulate the Lamarckian transmission, regardless of the adverse verdict of the biologists, for the good reason that they cannot get on without it; just as they postulate, for the same good reason, a mental or psycho-physical energy which has its source in our instinctive foundations and works in all our mental activities, in spite of the fact that the physiologists recognise no such energy and explicitly or implicitly deny it.

Some of the sociological historians, especially those of the school of Leplay, have similarly ignored the ban of the biologists and have freely used the Lamarckian principle in their speculative endeavours to account for the evolution and differentiation of the races and nations of men. They achieve at least some plausible and interesting, though inevitably speculative, accounts. Thus the urgent need both of psychology and of history for the Lamarckian principle is manifested. And the increasing prevalence of orthogenetic theories of evolution is evidence of the same nature; for it may be said, I think, of all such theories that they are put forward *faute de mieux;* that, if the Lamarckian principle can be accepted, all such theories become otiose, lose their *raison d'être.* Without that principle our understanding of man's nature, of organic evolution, and of historical development, all alike are at a dead end. With it they can take a new lease of life and progress indefinitely.

¶ 3. INTERPRETATIVE USE OF LAMARCKIAN PRINCIPLE. Let us consider how Mr Heard's interesting historical interpretations would find a solid basis in that principle,

if it could be accepted; and here again we may best fix our attention on the Renascence problem.

So long as men's lives are filled with those primitive fundamental activities by means of which all the more primitive peoples have maintained themselves, the tilling of the soil, hunting, fishing, tribal fighting and ritual; there is little occasion for any efforts of abstract thinking; no new problems arise; no novel modes of dealing with men and things are required; their lives follow in the main the lines of instinct and fixed custom. Hence, we may suppose, the stable, unchanging character of the peoples that are purely or predominantly tillers of the soil. The peasants who form the great bulk of the population of India, of China, of Egypt, continue century after century to perform the same daily tasks, meet the same ever recurring problems in the same ways, worship the same gods, practice the same rituals, use the same language and think the same thoughts, acquire similar sentiments of love and hate for similar objects. If, then, individual efforts at new adaptations are the mainsprings of evolutionary progress, the generators of adaptative mutations, how should such peoples not remain stationary? Only great changes of the physical environment, such as the advance and retreat of the polar ice cap in the glacial periods, could force such people to new adaptations, new modes of thinking and feeling and acting.

A similar but briefer period of changeless stability fell upon Europe when the Roman Empire had consolidated its conquests. The most significant difference between

that Empire, with its predominantly agricultural populations and its uniform system of Romanised law and custom, and modern Europe, is the lack of all intellectual and moral progress in the former. Throughout many centuries there was no invention, no discovery, no great change of sentiment, no substantial improvement even of the military arts on which the Empire was founded and on the practice of which its existence continued to depend. The one great change was the spread of the Christian religion; but religion is always in the main a conservative, stabilising influence, rather than a stimulus to other changes.

¶ 4. MATURATION—CREATIVE THINKING. What, then, according to this view, was there in European conditions peculiarly favourable to that outburst of creative thinking we call the Renascence and to the modern progress of our Western civilisation? It was the variety in unity which resulted from the shattering of the Roman Empire by the Northern barbarians. Even a Roman general, when he saw his legions crumpling before the barbarian onslaughts, might begin to think. Even the Roman lawyer would have to modify his codes and his practice when he no longer had to deal only with submissive peasants and petty provincial traders. Even the Roman bishops would have to expand and modify their system when faced with the task of bringing into the church the worshippers of Thor and Wotan. Throughout Europe there were chaos and conflict, new problems to be solved, new adjustments to be made. And the political and social adjustment produced

a Europe, still unified by the Roman Church, by Roman law, and Roman language and culture, but divided into a multitude of feudal monarchies in rivalry with one another; everywhere diversity and conflict within a unity, one civilisation.

Suppose now it be true (as the evidence seems to indicate[1]) that some thirty generations of adaptative effort are required before the modifications of mental constitution thus produced accumulate to the point of effectiveness, before the modification, slowly shaping under these efforts of successive generations, breaks out in distinct mutations. That would mean a thousand years of such efforts before the effects burst out in the form of a crop of individuals of restless enquiring minds, questioning all accepted principles, breaking everywhere the bonds of custom, prying, experimenting, moved by that divine discontent which is the root of all progress. "The East bow'd low before the blast. In patient, deep disdain. She let the legions thunder past. And plunged in thought again". Europe ceased to dream and turned to vivid action, because European culture was stirred and stimulated and renewed by many minds that were not content to dream; because the capacity for abstract thinking was no longer a rarity, but rather, owing to the necessity for new efforts imposed upon a succession of generations and involving in each generation a large part of the populations of the European kingdoms, had become a capacity shared in various degrees by a large number of men in every part of Christendom.

[1] *Cf.* p. 209.

¶ 5. EVOLUTION OF HIGHER MORALITY. On the moral side the conditions, though leading to a similar result, a parallel change, were different. Here uniformity rather than diversity of conditions is required by our theory. And, as we have noted, Europe throughout the middle ages was the scene of diversity in unity. The unity was the unity of Christendom, the uniformity of Christian morals insisting on the brotherhood of all men. This was a new principle. The cultured Athenian sent his fellow Greek to groan out his life under the slave-master's lash, in silver mine or galley. Cultured Romans shared the delight of the multitude in seeing their fellow citizens torn by wild beasts. The cultured disciple of Confucius countenances and prescribes the most horrible tortures as instruments of the law. The mediæval European burnt the heretic alive and extorted confessions by official torture. But in Europe there was throughout the mediæval period a new influence at work, the Christian doctrine of human brotherhood. And Europe became Christendom long before the modern period.

¶ 6. INEFFECTIVENESS OF TEACHING. Why, while mediæval Christians tolerated and practiced torture, do modern Christians and their agnostic fellow-citizens conspire to prevent a man from displaying his strength and skill in throwing a steer with his bare hands, *out of consideration for the steer?* All alike have been taught the doctrine of human brotherhood. Why was such teaching so ineffective for a thousand years? Why so seemingly effective now?

Why, if the spectacle of human torture was sought with delight by our forefathers through long ages, do we now shrink in distress from the thought of a bruised steer? According to all accepted theory, a standing mystery; one of the great paradoxes of history! It is a special problem of the frontier-region between history and psychology. The problem is posed by history. It can be solved only by psychology.

¶ 7. EFFECTIVENESS OF SENTIMENTS. The answer is to be found in the theory of the sentiments. Neither teaching nor preaching, nor both together, can do much to modify the actions, the feelings, and the emotions of men.

All our more refined modes of action, of emotion, and of feeling spring from our sentiments. And sentiments are complex systems of the mind that grow only slowly in each individual. Teaching can do little to promote or shape their growth. But personal influence is all important. The sentiments, especially such higher sentiments as love of justice, hatred of cruelty, admiration for nobility, grow in each child chiefly through emotional contagion from those in whom they are already powerful to shape action and emotion. Example, not precept, is therefore all-important. But example also is of little effect on the individual whose nature is not prepared to react sympathetically. The compassionate concern of the good Samaritan may move one man to equally compassionate activity, while another turns away with a contemptuous laugh.

¶ 8. DEVELOPMENT OF SENTIMENTS. The Roman boy who accompanied his parents to the Coliseum readily learnt to delight in cruel scenes. Such cruelty is not the expression of any positive factor of the mind. It is not the expression of any specific instinct, nor yet of any sentiment, of cruelty. It is rather merely the unchecked indulgence of the crude and primitive tendency to find pleasure in whatever conditions excite us violently without causing us pain. Fortunately there is here no positive acquirement which, by repetition through the generations, might become ever more firmly fixed in the constitution of the race.

On the other hand the same boy, if his father was of the compassionate type most susceptible to the attraction of Christian teaching, might be stirred by his father's compassionate reaction to react similarly to the spectacle of human agony, and might readily be brought into the company, and therefore under the influence, of like-minded persons, persons most open to the Christian teachings of mercy and charity to all men. Thus he would become a member of a group in which through teaching, but still more by moral contagion from each and all to each member, there was formed the power of conceiving vividly such abstract objects as charity and mercy; and further, and of chief importance, there would be formed in him, as in all members of such a group, a sentiment of esteem, of love or of admiration, for such qualities of character and conduct wherever and by whomsoever displayed. Then, if the Lamarckian principle is valid, the susceptibility to such emotional sympathetic reactions

will not only be increasingly exercised in each such individual, but his offspring will be endowed, in however slight a degree, with a similarly enhanced susceptibility and with the rudiments of such moral sentiments as love of all charitableness and hatred of all cruelty.

Such groups, supported and strengthened by the growing prestige of the Church, would have spread their contagious influence through ever widening circles. And the cumulation of such slight modifications through many generations would finally result in the birth of children who spontaneously, without precept and without example, react with passionate anger to all injustice and all cruelty, and are moved to compassion by every, even the slightest, sign of suffering in man or beast. That such children are born into our modern world in not inconsiderable numbers no one, I think, will deny. They become the fanatic promoters of societies for prevention of cruelty, the devoted Red Cross workers, the Nurse Cavells and the Florence Nightingales, the Mary Webbs, the Father Damiens, who, in a world still groaning from the inhumanity of man to man, redeem the record of mankind, lift us to new levels of respect for our race, give us new hope for its future.

¶ 9. THE LAMARCKIAN HYPOTHESIS. Thus the acceptance of the Lamarckian principle fits the facts of history remarkably well. The special case discussed is only one of many that are capable of similar interpretation in terms of that principle, and are difficult or impossible to understand if it be denied. Not only the sociologists of the Leplay

school, but very many historians (ignorant for the most part of the state of biological opinion and indeed not clearly aware of the assumption they are making) imply the validity of the principle in their speculations. Everywhere human nature seems to bear the impress of its environment; everywhere the special forms of activity and adaptation to which men have been impelled for many generations by special conditions seem to have created in the race propensities to such forms of action.

¶ 10. EVIDENCE FOR IT. Putting aside, then, as of no weight or validity the objections to the Lamarckian principle founded in the mechanistic materialistic dogma, let us see what is the state of the evidence. It is a frequent assertion of the Neo-Darwinists that many attempts have been made to demonstrate experimentally the validity of the Lamarckian principle, and that all have failed. This is simply an untrue statement; unless we mean by 'failure', not failure to produce positive evidence, but failure to clinch the matter in a way that leaves no possible loophole for the most ingenious and resolute adversary. To demand such a demonstration is unreasonable and shows ignorance of the nature of scientific evidence and proof. As in all other scientific problems, we cannot expect to attain to absolute proof, but only to demonstrate with some high degree of probability. That organic evolution has taken place can never be absolutely proved. It must always remain a theory more or less well founded. The sceptic can, if he so pleases, reject it in favour of the theory of

special creation, without being guilty of mutually contradictory statements.

¶ 11. WELL AND BADLY PLANNED EXPERIMENTS. The truth in this matter is that many of the experiments directed to throw light on this question have been as unintelligently conceived as that of Weissmann when he cut off the tails of mice through twenty generations, and, finding that the tails of the twenty-first generation were no shorter than those of the first, adduced the fact as evidence against Lamarckian transmission.

The problem is not an easy one; if we approach it with stupid and clumsy methods we may not hope to solve it. Nor is it likely that anyone who sets out to attack this problem with the conviction that an animal is merely a machine will reach any other than a negative conclusion. The problem is not one of mechanics but of psychobiology; it requires to be handled with psychological understanding.

¶ 12. POSITIVE EVIDENCE. On the other hand, we have on record a number of experiments and observations which do amount to positive evidence. And, if this evidence is not conclusive, it is because, in the very nature of the problem, alternative interpretations of any positive experimental result cannot be excluded as absolutely impossible.

Of all these I am so partial as to regard my own experiment, begun in the year 1920 and still going on, as affording the strongest positive evidence hitherto obtained. It

consists in inducing in successive generations of rats (37 generations have now been trained) a particular form of adaptive behaviour; measuring accurately in each generation the facility with which the adaptation is achieved; and finding a very marked increase of facility in the successively later generations. Every precaution has been observed and every attempt has been made to explain away this result as other than a case of Lamarckian transmission. I venture to say that no serious flaw has been found either in the procedure or the interpretation; and no plausible alternative interpretation has been suggested. I submit that we have now such positive experimental evidence in support of the Lamarckian theory as justifies us in applying it to the interpretation of the problems of history and sociology.

CHAPTER XVI

THE NATURE OF VALUE AS A FRONTIER PROBLEM

¶ 1. VALUE AND VALUATION. Let us turn now to the other great group of human sciences, the sciences concerned with value, and select for brief consideration, as a typical frontier problem, the most fundamental problem with which they all are concerned, the problem of the nature of value and the valuating process. How and why do we discover value in, or assign value to, any object or event, any class of things or processes or qualities or relations?

I say the problem is fundamental; a correct solution of it is urgently required as the essential foundation of all these sciences. It is for lack of such foundation, of an agreed and true foundation, that all of these would-be sciences are still floundering wildly. The last statement is most obviously true in respect of that science whose conclusions are brought most directly and frequently to the pragmatic test, namely economics. But it is no less true, though less obviously so, of the other sciences of value, or, to describe them more accurately, those fields of blended philosophical and scientific enquiry which we call ethics, politics, æsthetics, jurisprudence, and the rest.

¶ 2. ECONOMIC VALUE. We may with advantage keep in view primarily the problem of value and valuation as it arises in economics. Here the problem appears on the face

of it very simple, easy to solve; but this appearance of simplicity is illusory. Many economists seek to avoid it by defining their science as the science of wealth, or of the production or acquisition of wealth. But thereupon the question arises: What is wealth? And if it be defined as all those material things that contribute to human welfare, we ask: What then of those tokens which we call cash? What of credit? What of confidence, the lack of which has been described by a thousand economists as the principal ground of the present widespread and suddenly accentuated poverty? What of climate, health, hygiene? What of ability, reputation, prestige and 'good will'? These things may not be found in the list of market prices; but they may be of great economic value. The knowledge of methods to prevent malaria is of immense economic value; but it is not a material thing. Harmonious relations between employers and employed are of immense economic value; but they certainly are not material things. The same may be said of political security, peace, order, administrative efficiency and honesty. And all high intellectual and moral qualities of all persons concerned in the economic processes are of the highest economic value; in their absence, wealth and welfare can never rise beyond a low, an almost negligible, level.

¶ 3. ECONOMICS AND PSYCHOLOGY. Economics poses the question; but the answer can be supplied only by psychology. The earlier economists recognised this fact. But they made the mistake of supposing that they had a

true and adequate psychology at their command. Adam Smith was a considerable psychologist; his *Theory of the Moral Sentiments* was a real contribution. Yet he never clearly envisaged the problem of valuation. What he did was to distinguish use-value and exchange-value (or price) and to set forth the 'labour-theory' of price, neglecting wholly the prior enquiry into the nature and meaning of value in general. He sought to answer the question: What gives exchange value to any thing or commodity? And his answer was: The amount of labour put into the production of it.

Jeremy Bentham, the founder of the utilitarian school of ethics and politics, cut the Gordian knot with an arbitrary dictum, one which seemed to him, and to many others before and after him, so clearly dictated by common sense as to require no examination. Namely, whatever gives us pleasure, or contributes to our pleasure, is of positive value. Whatever detracts from our pleasure or gives us pain is of negative value. A most plausible, but most misleading, formulation, one which has been father to a host of errors in economics.

Later economists for the most part have followed one or other of these two leads. Either, like Ricardo and Karl Marx, they followed Adam Smith and burked the fundamental problem; or, like J. S. Mill, they accepted Bentham's hedonistic answer to the value-problem, variously attempting to remedy the more obvious defects of that fundamentally false theory.

The result was most unfortunate. The problem of

valuation is essentially a psychological problem; not until we have a sound psychology of valuation can any of the sciences of value be soundly based. But there were the economists divided into two parties, those who completely overlooked this foundation problem, and those who accepted a false solution. This state of affairs was largely responsible for the still more unfortunate and almost incredible pecularity of economics at the present time; namely, the total blindness of so many economists to the fact that their problems are largely psychological, that the 'economic forces' they constantly discuss are mental forces, the desires and strivings of men. For, since the party which recognised the fundamental psychological problem of value accepted and dogmatically taught the false and unworkable hedonist theory of value, the psychological method fell into disrepute, and has commonly been neglected or explicitly repudiated (as by most English and American economists at the present time).

¶ 4. PSYCHOLOGY OF VALUATION. The honour of making a vigorous attack on the psychology of valuation belongs to a group of Austrian thinkers, some of whom, like Carl and Anton Mengen, von Wieser, and Böhm-Bawerk, were economists, others, rather, philosophers, as F. Brentano, Ehrenfels and Meinong. The former devised and elaborated the 'marginal utility theory' of economic value, the espousal of which by Jevons introduced a second piece of false psychology into the foundations of English economics. The others went more deeply into the problem of values

in general; and in their hands for the first time the true theory began, somewhat waveringly, to take shape. Nietzsche quite independently pointed in the true direction.

¶ 5. THEORY OF VALUE. Without delaying to attempt to assign credit to various writers, let me try to outline very briefly the true theory of value as it now emerges; and let us keep economic value specially in mind.

The problem of value has three necessary parts or sub-problems; each of which requires its psychological solution before we can achieve a general theory.

First, from what kind of experience does valuation primarily result and how? This part-problem may be put more explicitly, as follows: Simple valuation takes the form of simple judgements: This is good; that is bad. All developed valuation is the issue of comparative judgement, such judgements as: This is better than that. How are such judgements arrived at, how determined? If valuation involves judgement, is it a purely intellectual or rational function? No; reason has a rôle to play in reducing our valuations to an orderly consistent system; but of itself it cannot discover or produce intrinsic values.

¶ 6. INTRINSIC AND INSTRUMENTAL VALUES AND THE RÔLE OF REASON. The distinction between intrinsic value, on the one hand, and instrumental or derived value, on the other, is fundamental to all clear thinking on this topic. The use of a certain instrument may enable us to attain some object that we desire. The object desired for its own

sake is an object of intrinsic value; the instrument, or means, useful for the attainment of that object or end then has instrumental value. If you desire an apple at the top of the tree, a ladder, or any other device that will bring it to your hand, will have instrumental value, value derived from that of the apple. Reason can show us what instruments or means are useful for the attainment of intrinsic values; and, therefore, when you have judged certain things to be of intrinsic value, reason can lead you to discover the instrumental value of various means for the attainment of those intrinsically valuable objects.

Further, almost all things of intrinsic value are of value also as means to other values. For example, the apple you desire has intrinsic value, but also it may have value as means to health, another intrinsic (though also an instrumental) value. Again, when we have established some quality as intrinsically of value, reason may help us to ascertain whether a certain object has that quality; to ascertain, for example, whether a certain person has the quality of sincerity.

Thus reason has a large rôle to play in the ascertainment of values. Yet a secondary one only. Many philosophers have represented the rôle of reason to be larger than it actually is; they postulate some one supreme good or intrinsic value, and then regard all other values as instrumental, as derived from that one. The one supreme value most commonly assumed is happiness. In that case we have a refined form of the hedonist doctrine. But it is as false as the crude hedonism which asserts that all value is, or consists in, pleasantness of sensations; that all pleasant

sensations and only pleasant sensations (or pleasures of sensation) are intrinsic values. When, then, we have given full recognition to the rôle of reason, the fundamental problem remains: What is the ground of valuation?

¶. 7. DESIRE THE GROUND OF VALUE. In the most wide and general sense of the words, the primary and fundamental ground of all valuation is desire.[1] Here we must clear away a popular fallacy. To the question: Why does one desire *this*? a popular answer is: Because *this* is good. But that leaves the question: How do we arrive at the judgement, *this* is good? The answer inverts the true relation. Primarily and fundamentally we judge *this* to be good because we desire it. If the young child could put into words his experience as he reaches eagerly for some fruit that is new to him, he might say: 'I find myself striving for that; it must be good'. And on attaining and enjoying the eating of the fruit he might say: 'Yes, it is good! I must have another'. Further experience of *this* (this kind of thing) may then confirm or modify or reverse the judgement. If, on attainment of *this*, our desire is satisfied, the judgement of value is confirmed, and the tendency to strive for things of that kind is strengthened. If the desire is only partially satisfied, we judge the object to be of less value than we had at first supposed; if attainment brings no satisfaction our judgement is reversed and becomes: 'This is not good'.

[1] I use the word widely and loosely as the equivalent of the more technical word 'conation'.

¶ 8. DESIRE ROOTED IN INSTINCT. What, then, is the ground of desire? How and why does desire spring up? There are two rival theories and two only, the hedonist and the hormic. The hedonist theory says that man desires this or that because it has been found to yield pleasant sensation. The hormic theory says that desire is primary, that man, like all other animals, is so constituted that, under appropriate conditions, on perception of objects of certain kinds, desire springs up independently of all prior experience (whether pleasant or otherwise) and that the attaining to the object or goal of desire is the fundamental ground of all pleasantness or pleasure.

There is an old fable which embodies so perfectly this hormic theory that it must be recited here.[1] A certain rich misogynist resolved that his only son should never marry. With this end in view, he kept him in strict seclusion from all women until adult. On his twentieth birthday he took his son to town, promising to give him whatever he might most strongly desire. On the road they passed by a farmer's cart in which rode a young girl going to market with her father. 'What is that strange creature?', asked the youth. 'That is a goose, my son; all such are worthless troublesome things. Think no more of them'. Before the town was reached, the incident was repeated more than once. When the son had surveyed all the attractions of the local Bond Street, the father asked: 'Now, my boy, what shall be your birthday gift'? Without hesitation came the reply: 'Father, give me a goose'.

[1] It is the crude version of Meredith's *Ordeal of Richard Feverel.*

'Man is born to trouble as the sparks fly upward'. And that is because he is born to desire, born with latent capacities for desire, which require only the spark of circumstance to flare out into conscious desire and active striving for the natural objects of desire. These latent inborn capacities for desire are known by various technical names; we may be content to speak of them as native propensities.[1] All desires of the simple primary kind manifested by the young child spring directly from such inborn dispositions or propensities; and at this level all valuation is directly determined by such primary desires or impulses. It is futile to ask the child: 'Why do you desire this'? He knows not why, and can only reply: 'Because I do', or, 'Well, I *do* want it'. Only a sophisticated person will return the answer: 'Because it is good'; or 'Because it is of value', or 'Because it will give me pleasant sensations".[2]

[1] Few psychologists take the trouble to distinguish between, on the one hand, the latent inborn capacity for desire, on the other hand, its active manifestation. The former is variously called *conative disposition, native propensity, instinctive tendency*. The latter is spoken of as *urge, impulse, conative striving, desire, endeavour, active tendency, hormic impulse, effort*.

[2] As authoritative support for this account of primary value, I cite Dr S. Alexander's recent work *Beauty and other Forms of Value*; London, 1933. Alexander teaches that all æsthetic value is rooted in a single propensity, the constructive propensity; that æsthetic activity, whether productive or appreciative only, is sustained by the impulse of this propensity, and æsthetic satisfaction is, or contains as an essential constituent, the satisfaction of the constructive impulse. Without

¶ 9. POSITIVE AND NEGATIVE DESIRES. Before we go further, we must observe a distinction neglected up to this point of our discussion, namely, the distinction between positive and negative desires or impulses. Negative desire is more properly termed aversion. While some of the native propensities generate only positive desires (*e.g.*, the food, the sex, the protective, the constructive, the enquiring, the social propensities) others (especially those of disgust and fear) generate aversions. We might adopt and transfer to this sphere Prof. Soddy's two words *tractation* and *pellation*,[1] and say: Positive desire is tractation, or tendency towards; negative desire or aversion is pellation, or tendency away from.

All primary valuations, such as those of the young child, are, then, positive or negative according as the object evokes from some propensity its positive or negative impulse, impulse towards or away from the object, desire or aversion.

¶ 10. THE MORE ENDURING VALUES FOUNDED IN SENTIMENTS. As an isolated creature the child could go beyond this primary stage of valuation, though not very far. For example, the fruit desired and attained on the first encounter, is repeatedly enjoyed. It becomes a standing object of desire; a special satisfier of the desire for food. We say the child has learned to like or love that fruit.

endorsing this view unreservedly, I cite it as being drawn on correct hormic principles. It is, I think, over-simplified.

[1] *Cf.* p. 128.

On the other hand fruit of another kind may on the first encounter provoke desire; but on nearer acquaintance, on mere smell or taste or ingestion, may provoke the strong aversive impulse we call disgust. A few repetitions of such experience suffice to generate a standing aversion; the child learns to dislike all such fruits. Having thus acquired, through repeated experiences, enduring likings and dislikings, he attaches positive value to that which he has learnt to like, negative value to that which he has learnt to dislike. Such likes and dislikes are rudimentary or very simple sentiments.

Unaided the child can form more complexly organised standing likes and dislikes. For such objects as his home, his mother, his little sister, his dog, he may spontaneously acquire, through the repeated evocation and satisfaction of various positive impulses or desires, a standing or habitual 'tractation', a love of the particular object. Similarly, if any person repeatedly evokes in him aversive impulses of fear and anger and disgust, that person will become an object of hate. Such love and hate are relatively simple sentiments of a kind which determine a considerable range of valuations, of value judgements. 'My precious child'! is the perfectly natural expression of a valuation springing directly from the sentiment of love. Or we naturally say: 'I do love him, he is so good'. On the other hand, when we have learnt to hate another, we naturally describe him as 'a worthless creature', as 'an abandoned wretch', as 'a poisonous beast', or as 'a bad lot'. When we say that love and hate are blind, we recog-

nise this fact of the determination of our value judgements by our sentiments. Love makes us more acutely aware of every feature and aspect of the loved object; but it blinds us to its defects as such, determines us to positive valuations of all its qualities. The freckle, or the mole, or the lack of seriousness, becomes for the lover, not a blemish but an ornament.

¶ 11. SOCIAL INFLUENCES ON INDIVIDUAL VALUATIONS. We said (p. 215) that the problem of value has three parts, or comprises three sub-problems. We have briefly dealt with the first of these, the sub-problem of strictly individual valuation.

The second sub-problem takes us into the field of social psychology. We have to recognise, and as far as possible explain, the fact that the valuations of any normal individual reflect in large measure the socially current valuations, the values of his time, place and social circle. Every community, every social class and group, besides sharing the values of the larger whole of which it is a part, has its values, valuations, and standards of value peculiar to itself and all its members.

The prevalence of a system of accepted values is the main ground of the unity of any social group, of such harmony and coherence and stability as it enjoys, and of the effectiveness of its collective activities. The community of values is the basic fact for all the social sciences, a fact which must be psychologically understood and explained before the social sciences can be firmly founded.

¶ 12. NECESSARY GROUP VALUES. In respect of certain fundamental goods, community of valuation is thrust upon all members of a group by sheer force of the common environment. Thus, in a dry climate all water-sources have a high value for all men. In some regions man is dependent for his livelihood on the horse; accordingly all men set high value on the horse; and the horse-thief is, by common agreement, shot down at sight. In similar fashion the pastoral nomads who entered and conquered India from the North West were dependent on their horned cattle; in consequence, to this day, although they have been agriculturists for many centuries, the cow is a sacred beast. But such instances form but a small proportion of the multitude of community values.

¶ 13. SENTIMENTS AND GROUP VALUES. Why do all Englishmen think cricket-scores the most important things in the world? Why do Americans behave like emotional children over College football? Why are *ésprit* and *la gloire* universally esteemed in France, fairplay and self-restraint in Britain, *Kultur* and *Sauerkraut* in Germany, aggressiveness and sociability in America? Why is kindness to animals almost universal in one country and almost unknown in another? Why and how, in short, are the members of each class and community moulded to one distinctive pattern so that, in spite of marked individualities, they are easily recognised by their valuations?

The theory of the sentiments is the key to the problem;

but it requires to be combined with the theories of suggestion and of sympathy.

We have seen that our sentiments of liking and disliking, of love and hate, of respect and admiration and contempt, determine all our intrinsic values except the crudest and simplest. Community of values, then, is mainly an expression of community of sentiments, especially of those of the more impersonal kind. Yet even personal sentiments owe something of their form and substance to community influences. Nothing is more intimately personal than a man's love for his children, his wife or his sweetheart. Yet even these most individual sentiments commonly conform to the current types. There is a British, a French, a German, and an American way of loving one's wife, one's mother, one's son, or one's daughter. While the Englishman's sentiment for his king, for country-life, for his home, his liking for privacy, for independence, for free speech, are traditional and distinctive. It is the assemblage of such community sentiments that make the national type, the professional type, the Oxford man, and the Cambridge man, and even the Balliol man and the King's College man.[1] The Yorkshireman, the Bostonian and the Californian are types similarly distinctive in virtue of special distinctive sentiments or forms of sentiment.

The totality of a man's sentiments and of his valuations founded in them constitute what we euphemistically call his philosophy of life, 'the Greek view of life',

[1] Hence it is often possible on reading a book by an English scholar to make a shrewd guess at his university and even his college.

the Englishman's or the Scot's or the Frenchman's philosophy.

¶ 14. SENTIMENT, SUGGESTION AND SYMPATHY. These uniformities of sentiment and these traditional and distinctive systems of valuation pervade all sides of life, the economic and the æsthetic no less than the moral and the political.[1] Racial peculiarities, no doubt, play some part in bringing about these uniformities and their peculiar distributions; but suggestion and sympathy are the influences to which they are chiefly due.

It would be out of place to take up here the controversial problems concerning suggestion and sympathy. It must suffice to say that we are so constituted that we tend to judge and believe as we find others judging and believing, especially those to whom we look up, all those whom we reverence, or regard with awe, deference, respect, admiration, or reverence. That is the fact of suggestion or general suggestibility. And we tend to react towards all expressions of feeling and emotion and desire on the part of such persons with similar feeling, emotion and desire. That is the general law of sympathy. And the more we look up to such persons, the more strongly do they influence us in these two closely allied ways. Hence the child's growing sentiments are moulded, by the constant working of these two principles, into conformity with those of his family and community. And in later years the outstanding

[1] Think how English appreciation of wild mountainous landscape has undergone a profound change since the Eighteenth Century.

members of any community, its successful, powerful, generally respected and admired members, exert a wide general influence of the same kind.

But an even greater and more general influence of the same kind is exerted by the community as a whole. For its power and prestige are overwhelming; and where its reactions are uniform, where it manifests a common opinion, common feeling and emotion and desire, its suggestive pressure upon each individual is very great; and its collective affective reaction is intensified by reciprocal sympathy from member to member, and is brought to bear upon each individual in all his contacts with fellow members.

Suggestion, then, especially suggestion from the group as a vaguely conceived whole of unlimited resources, power, and prestige, plays the chief part in determining our judgements of instrumental value; for, as we have seen, these are relatively independent of our sentiments and feelings. While sympathy, determining the form and intensity of our affective reactions, guides the growth of our sentiments, bringing them into conformity with those of the community; and thus, indirectly through our sentiments, shapes our judgements of intrinsic value.

In the various fields of valuation the proportion of instrumental values and of intrinsic values is very different. In economics the instrumental values predominate, and therefore suggestion plays the chief rôle; in æsthetic the intrinsic values predominate, and therefore sympathy is to the fore. The other fields of valuation lie in this respect between these two.

¶ 15. THE DEVELOPMENT OF COMMUNITY VALUES. Consider now the third sub-problem. How do the great socially recognised values, the community values, become established as traditions which mould the successive generations of any community to its distinctive pattern? The solution of this problem is in large part given by the same principles, the pressure of environment, and the working of suggestion and sympathy.

We must consider first the intrinsic community values; for the instrumental values are derived from these. We have to do with a long continued evolution in the course of which two factors play the chief rôle. First, the creative influence of great men. Secondly, a process of natural selection among the rival and sometimes incompatible values.

¶ 16. RÔLE OF GREAT MEN. The rôle of great men is perhaps clearest in the æsthetic field, where the standards of beauty and the canons of art are so obviously shaped in the main by a comparatively few great artists and by them imposed on the lesser artists and the masses. But the same is true in only less degree of the ethico-political sphere. The prophets of Israel afford a leading instance of such shaping, such creation and refinement of a people's moral values by great leaders. The British love of freedom has been created and renewed by such leaders from Boadicea to Wallace and Bruce and Milton and Hampden and Cromwell and Wilberforce. And then the immediate influence of such men is vastly extended and re-enforced

by the bards, the poets, the dramatists, the historians, the sculptors, the painters and actors who celebrate their persons, their deeds and their ideals, with every form of art that can enhance their prestige, artistic creations which work by suggestion and sympathy upon the masses of the people to shape their sentiments and, through them, the primary community values.

Community sentiments, thus engendered, become the parents of customs and of laws; and it is at this stage that rivalry and selection set in, in the course of which some survive and grow more vigorous, others are weakened or become modified, or die away gradually into desuetude, or are eradicated in some acute conflict and convulsion.

The philosophers, whose business it is to revise and rationalise the valuations of the community, have also played a rôle in the later stage of the evolution of community values, the stage at which men have self-consciously sought to understand, to justify, and to improve their practices; and some, like Socrates and Plato, Rousseau and Voltaire, Locke and Spinoza, Hegel and Fichte and Bentham and Nietzsche, have had considerable influence. Yet it is to be noted that they exert their influence, not so much by purely intellectual reasoning, as by persuasion, the art in which reasoning is subtly blended with suggestion and appeal to the sympathy of the hearer and reader; the art which in earlier days than ours was practised with greatest effect by the orator. Though it would be a mistake to assume that the day of the orator is over. Throughout the Nineteenth

Century oratory continued in America to be the most effective of the persuasive arts; and, in contemporary Europe, Mussolini and Hitler have shown that it may still produce immense effects in shaping the sentiments and the values of a people.

¶ 17. ECONOMIC VALUES. In the field of economics discussion has been concerned chiefly with instrumental values and has too much neglected the problems of intrinsic values. Especially has this been true of British economics. It has been conceived in the main as the science of wealth or of the production of wealth; and wealth is only of instrumental value.

In this sphere we have, on the largest scale, an illustration of a general psychological principle, a universal tendency of our minds, namely, the tendency to convert instrumental into intrinsic values, in other words, the tendency for sentiments to grow up about the objects, the things, the processes, the qualities, the relations which, in the first place have acquired value merely as instruments or means. We see the tendency illustrated most clearly by the miser who comes to love wealth or money. But in these days most men become misers in some degree, valuing and seeking wealth for its own sake; and the neglect of the problem of intrinsic value by economists must be regarded as expressing this tendency. It is because of this neglect that economics has been heaped with reproaches by such writers as Ruskin and Kropotkin; has been called the dismal science, the most inhuman of the social sciences;

and indeed its errors and shortcomings have been largely due to this neglect.

By reason of this almost exclusive concern of economics with instrumental values, suggestion has played a far larger rôle than sympathy in creating the accepted community values of the past, as we see in such striking instances as the value attached to gold and the gold-standard, to free-trade, to absolute property rights in land and minerals, to freedom from State-control, to private capital, to regulation of prices and production by free play of supply and demand. These and many other widely accepted economic values have arisen through the experience of practical men aiming merely at increase of wealth; and they have been rendered community values, have been foisted on the community, by the power of suggestion wielded by successful wealth-seekers, aided and abetted in the process by professional economists.

¶ 18. CONTEMPORARY RE-VALUATION. Many of the great changes of law and custom going on at the present time are due to refinement of our economic values through going back to the problems of intrinsic value, and through developing in the community, by the agency of sympathy and appeal to the emotions, new sentiments and therefore new intrinsic economic values; such are the changes leading to greater regard for fair distribution of wealth, of opportunity, of consumption of goods; for the effects of work on the workers; for harmony, cooperation, initiative, interest in, understanding of, and satisfaction accruing from work;

for the contribution of each type of work, not merely to the wealth of individuals, and not merely to the welfare of individuals, but to the welfare of the community as an organised whole.

If any reader is inclined to doubt whether sentiments and changes of sentiment can be of much economic importance, let him consider a few very striking concrete cases. The change of sentiment which, since the war, permits women to smoke and to smoke in public has made the manufacture of cigarettes a most remunerative and expanding business, one of the few which have continued to expand in spite of the great slump. A contrary change of sentiment might halve it in a few years. The change of sentiment which approves of a liberal use of cosmetics has led to the development in a few years of one of the largest industries. A growth of sentiment against huge profits, huge salaries and huge accumulations of private wealth is already working great social changes. The growth of sentiment against the making of private profits from the manufacture of the weapons of destructive warfare, and against prostituting scientific research and knowledge to purely destructive purposes, is apparent. These last sentiments may yet abolish war. Growth of sentiment against the economic exploitation of subject peoples has already produced considerable effects. And, most striking of all at the present moment, the development of national sentiment leading to a higher valuation of national independence seems to be transforming the economic structure of the whole world.

In short, a re-examination of intrinsic economic values is

the order of the day. It is led not so much by the professed economists; but rather by social reformers who rebel against the hitherto accepted economic valuations. These, in the main, argue, not that the proposed revaluation will increase our wealth in the narrow economic sense, but that there are great values other than wealth to which economic activities should contribute, even at the cost of less rapid increase of wealth.

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